THE
ELECTRICAL REVIEW.

VOL. LXXVII. MAY 14, 1915. No. 1,955.

ELECTRICAL REVIEW.

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ELECTROSTATICS AND INDUSTRY.

THE property of an electrostatic field, whereby it tends to sweep up all suspended particles within it and deposit them on the charged surfaces, is a phenomenon with which we have been acquainted from a very early period; but little use has been made of it until comparatively recently. There are two principal ways in which it may be manifested. One is by the mimic hailstorm of small pellets of pith or other light material between two metal plates, due to the actual charging of the pellets by contact with one of the plates and their subsequent repulsion from it and attraction to the other plate; this is a familiar experiment of the entertainment order, but probably has little bearing upon industrial problems. The other way is by the bombardment of electrons and ions due to the ionisation of the medium by the electric field, the floating particles being thus charged by the attachment or detachment of electrons without actual contact with either of the electrodes, and being then propelled along the lines of force of the field to the electrodes. It is by this means that the phenomenon is turned to good account on a practical scale.

It will be remembered that, some years ago, Sir Oliver Lodge, who has always been keenly interested in the phenomena of static electricity and allied questions, discussed the feasibility of employing this method for dissipating fogs on the large scale. Mr. B. H. Thwaite applied it experimentally to the purification of blast-furnace gases, but was hampered by the lack of suitable apparatus for generating a supply of static electricity—if it can be called static under the conditions of use.

In the United States remarkable progress has been made, with the aid of high-pressure transformers and mechanical rectifiers, and we give elsewhere in this issue some account of the methods recently employed and the results obtained. The earlier stages of the work were described in an article which we published in our issue of January 17th, 1913.

The simplicity of the apparatus and the small consumption of power render the system cheap to install and economical to maintain, while the efficiency of the process is surprisingly high, as much as 98 per cent. of the suspended matter, or even more, being deposited. In some cases the deposit itself contains valuable substances, the recovery of which may be worth many times the cost of its collection, and, indeed, we are told that at a Portland cement works the potash salts precipitated, which had previously wrought great injury to neighbouring orange plantations, proved to be an excellent fertiliser for the orange trees; the process may also be employed not merely for the prevention of nuisance, but as an actual intermediary to other industrial processes of manufacture. In other cases the sole object is to prevent the fouling of the atmosphere, as in the deposition of smoke, which probably offers the widest field of utility, and indirectly may confer immense benefits upon mankind.

In this connection we may emphasise the fact that the progress made in the United States has been due almost wholly to the efforts of a few men—especially Dr. F. G. Cottrell—who formed a philanthropic body for the purpose of research; the result of their work has been the repayment of the original capital and the accumulation, within three years, of ample funds to prosecute the work on more extended and efficient lines. It is especially significant that the money has been paid by clients who have found the process of commercial utility to their undertakings. The Research Corporation makes no profits for individuals. We strongly commend the subject to the notice of the British Coal Smoke Abatement Society, in the hope that that body may find it desirable to work on similar lines, and thus to accelerate the attainment of its altruistic aims.

As the power required rarely exceeds a few kilowatts, the kenotron, of which we gave a description in our last issue, appears to be ideally adapted for use in the process of precipitation, in place of the mechanical rectifiers hitherto employed; the fact was pointed out in the discussion by Dr. Dushmann. Curiously enough, the kenotron itself depends for its operation upon the flow of electrons between electrodes, with the vital difference that in this case the intervening space is evacuated to the utmost possible extent.

That knowledge of every phase of Nature is ultimately useful to man is further exemplified in this relation. First-year students in technical colleges, 10 or 20 years ago, we fear, despised if they did not abhor the rather flimsy apparatus with which they studied the phenomena of static electricity; but they were wrong. Even the electroscope, so apt to leak or to stretch its leaves to pieces, has proved to be invaluable in the investigation of radio-activity, to which we owe so much already. In wireless telegraphy, in the working of transmission lines at very high pressures, in the deposition of dust, in the acceleration of plant growth, and in other directions, the science of electrostatics has "made good," and we may yet owe to it the purification of the atmosphere and the improvement of crops on the largest scale.

A few days ago a deputation from the Royal Society and the Chemical Society pointed out to the Presidents of the Boards of Trade and Education that British industry was hampered by the starvation of scientific research and the lack of appreciation of scientific work on the part of the public generally, and advocated the adoption of measures by the Government for the assistance of scientific research. We are pleased to say that both gentlemen gave the deputation a very sympathetic reception and fully endorsed their claims, stating also that proposals were under consideration for the formation of an organisation for the purposes suggested. This is indeed good news. The undoubted success of the National Physical Laboratory bears out the statements of the deputation, and points the way to the attainment of their desires, in part; but the education of manufacturers and the public generally to an adequate realisation of the part that is now played by science in connection with industry, and the vastly more important benefits that it can confer upon the latter, ought to be vigorously carried on by every possible means, as one of the most effectual weapons with which to defend ourselves against our present and future opponents.

Rubber.

The tone of the market for rubber has been, on the whole, quiet during the past two or three weeks. There was at one time a tendency to improve, and a very fair volume of business was transacted, with No. 1 Crepe rising to 2s. 4½d. per lb., but this was the apex, and the market has since undergone a reactionary tendency, the full extent of the fall being not far short of 2d. per lb. It appears that arrivals from abroad are being dealt with more rapidly than was the case some time ago, which, of course, ensures a larger supply of material available for the satisfaction of trade requirements, while the demand at the same time has been on a rather less active scale. There has been some talk of difficulties experienced in connection with making shipments abroad, owing to the necessity of securing licences, and this may account to some extent for the easier tendency of the market just lately. Nevertheless, there is some confidence felt that Russian demands will develop on a large scale before long, and the resumption of navigation at Archangel is regarded as somewhat of a bull point. It is quite clear that production is making fairly satisfactory headway in the Near East, and it is significant that the cost of output is in all directions undergoing a marked and sustained reduction. It is impossible for the general tendency of rubber prices to be other than on the easy side while the average cost continues to fall, and while the world's trade is at sixes and sevens owing to the war. The exports of plantation rubber from the Federated Malay States during the month of April amounted to 2,777 tons, as compared with 3,418 tons in March, and 2,151 tons in the corresponding month of last year. For comparative purposes the following table of exports from the Federated Malay States will be found interesting:—

	1913.	1914.	1915.
January	2,131	2,542	3,473 tons.
February	1,757	2,364	3,411 ,,
March	1,737	2,418	3,418 ,,
April	1,626	2,151	2,777 ,,
Total	7,251	9,475	13,079 ,,

British Industries Fair.

The exhibition that is now in being, and will remain so until Friday next, at the Agricultural Hall, Islington, has afforded British industries an opportunity such as we do not think has ever occurred before of bringing together under Government auspices an imposing collection of articles in which there is scope for a very large turnover. It is not an engineering exhibition, nor is it, save in respect of a very few popular and specialised lines, electrical, but we do not criticise it on those grounds, for the hall is packed with a very excellent collection of all sorts of things which, generally speaking, cannot well be displayed side by side with electrical manufactures. We doubt if there is anywhere in London a building anything like large enough to accommodate all branches of industry with exhibits on such a scale as to satisfy everybody. To attain to such proportions we should have to organise on the vast lines that have characterised some of the great international exhibitions, and unless we monopolise the White City, the Crystal Palace, or some other such site, that is impossible in London. War time is not a convenient time for organising a mammoth exhibition—the present collection of manufactures has had to be organised and brought together in as many months as a big exhibition would have taken years. In some respects the conditions of war time, which have really given rise to the holding of this display, and made for its success, have militated against the making of the necessary arrangements by exhibitors. Considering all the peculiar circumstances of these times, we must congratulate the Board of Trade Commercial Intelligence Department and the exhibitors upon the excellence of their Fair. We cannot remember any occasion when an exhibition has been so complete on its opening day as was this one when Her Majesty the Queen made her tour of the Hall on Monday afternoon last. Though, as we have said, the exhibition is not devoted in anything but a casual way to the classes of manufactures which we represent, we welcome it as an excellent augury for the future. Though the Board of Trade may have been criticised for some things that it has done and in respect of some things left undone, it gives promise here of a development of a trade interest which cannot fail to meet with acceptance at the hands of industry, however much it may displease private exhibition promoters. We look to the Board of Trade, now that it has shown in these months of war how excellent a beginning it can make, to proceed consistently with the larger policy of trade encouragement that everybody industrial desires.

THE ELECTRICAL PRECIPITATION OF SMOKE AND FUMES.

At a meeting of the American Institute of Electrical Engineers in February, a symposium of papers was presented on the subject of the electrostatic precipitation of fumes, smoke, dust, &c., from which it appears that valuable progress has been effected in this important field. Dr. F. G. Cottrell, to whose work we recently referred, described very fully the history of the subject, which was mentioned as long ago as 1824; the work of Sir Oliver Lodge, which received special attention, led to the formation of the Research Corporation in the United States, by Dr. Cottrell and others, to study the process. Sir Oliver Lodge's work had been directed especially to the precipitation of fog in the atmosphere; that of Dr. Cottrell was directed towards the precipitation of fumes and smoke as the more pressing problem, which would assist in solving the former.

The progress of the work of the Research Corporation was described in a paper by Mr. Linn Bradley, who pointed out that there were dangerous pitfalls to be avoided, and that a process worked out to perfection in the laboratory might have to be enormously modified before it could be applied to practice; not only was it necessary to be fully conversant with the process itself, but also it was essential to be well acquainted with the details of operation of the plant to which it was to be applied.

The Research Corporation was organised in 1912 to develop certain patents assigned to it gratis by Dr. Cottrell and his associates, and the stock-holders were prohibited from ever making any profits from their holdings; the working capital was only £2,000, and therefore clients were required to pay all expenses incurred in connection with their particular problems. A commercial plant, designed by Dr. Cottrell, had then been at work for two years condensing sulphuric acid mist in a California smelting works, and this is still in operation.

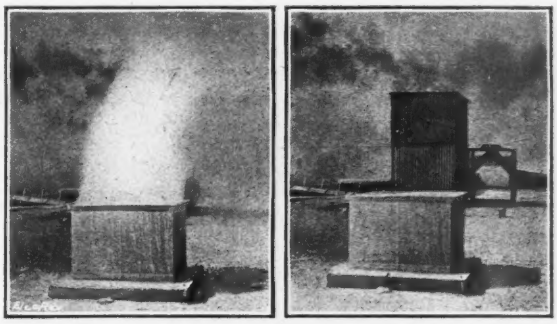
Experimental installations had been put down in other works, and electricity had been employed for separating water from crude oil with which it was emulsified. A plant installed at a Portland cement works in 1912 has been extended, and now deposits about 100 tons of dust a day from the gases from rotary cement kilns. In another case the gases from copper matte converters were treated, to reclaim the lead compounds, and this installation has been extended to the whole of the converters at Garfield, collecting over 95 per cent. of the suspended matter.

Briefly stated by Mr. Bradley, the method employed is to subject the gases and suspended particles to the action of a strong electric field maintained between "collecting electrodes" and "discharge electrodes." The current flowing through the gases must be unidirectional, and is obtained by transforming alternating current up to, say, 100,000 volts and rectifying it. Pressures up to 250,000 volts have been rectified successfully. The form of the electrodes depends very largely upon the local conditions, which vary greatly. Provision must be made for access to the electrodes and insulators, and for the removal of the dust or liquid deposited. Slight changes in the methods employed have sometimes converted apparent failures to complete successes, and no detail must be considered unworthy of attention.

At the Raritan Copper Works valuable fumes remained in silver refinery gases of a very corrosive nature, even after they had passed through a water scrubber. Cast-iron was used for some parts of the electrodes, and an alloy of lead and antimony for other parts. With 2·5 to 3 KW. at 35,000 volts, several thousand dollars' worth of fumes have been saved. An improved type of treater employing lead pipes, 12 and 24 in. in diameter, has been employed with advantage in recent additions, and further improvements have been made by installing a 10-K.V.A. 25-cycle single-phase 100,000-volt transformer. The deposited fume sometimes starts an arc between the electrodes, and to meet this difficulty an automatic device has been successfully adopted.

At the plant of the Hooker Electrochemical Co. a large volume of air containing a small percentage of chlorine gas is treated for the removal of the latter; hydrated lime dust is used to assist in the removal, and a few tons of weak bleaching powder are collected daily.

The volume of gas is 30,000 cb. ft. per minute, and the power used is 3 to 5 KW. at 50,000 volts. The effect of the treatment is shown in figs. 1 and 2.



Pressure Off. Pressure On.

Figs. 1 and 2.—Exhaust Flue from Treater at the Hooker Electrochemical Works, Niagara Falls.

A boiler used for testing coals at the U.S. Bureau of Mines was fitted with a treater to eliminate black smoke, consisting of 12 iron pipes 12 ft. long by 12 in. in diameter, through which the gases were led. The electrodes passed through the pipes, which were placed vertically, as shown in fig. 3. With one kilowatt at 50,000 volts the result shown in figs. 4 and 5 was attained. Mr. Bradley states that the smoke can be precipitated readily, and the insulation problem is not now a difficult one; the apparatus uses little power, and can operate continuously with but little attention.

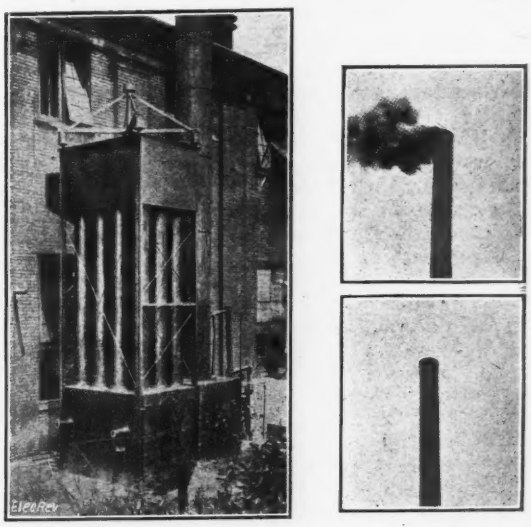


Fig. 3.—Smoke Treater at the U.S. Bureau of Mines.

Figs. 4 and 5.—Pressure Off and On.

The most puzzling question is what to do with the material deposited!

Many other examples were given by Mr. Bradley, such as the removal of tar from illuminating gas, the deposit of fume from sintering machines and detinning plant, dust from food product works, fumes from roasters, &c.

An important opening is found in the removal of mechanical impurities from gases containing volatilised substances such as arsenic, so that the latter can subsequently be condensed and recovered without further refining. An iron pipe as large as 4 ft. in diameter has been successfully employed as the collecting electrode, with a pressure of 250,000 volts and a mechanical rectifier. An installation for collecting potash salts volatilised from feldspar employs 40 pipes 14 in. in diameter and 12 ft. long, the electrode spacing being 7 in.; the temperature of the gases ranges from 500 to 1,000° F., and the volume dealt with runs up

to 18,000 cb. ft. per minute. The voltage is 70,000 volts, and the power factor 70 to 80 per cent.

An installation for collecting volatilised hydrochloric acid was recently put down with complete success at the first attempt, the exit gases being so free from acid that a trace of it could hardly be detected by delicate chemical tests. Treaters are also being installed at sulphuric acid works, to eliminate suspended particles from sulphurous gases before delivery to a Glover tower; in this case the treater will be in three sections, any one of which can be laid off for repairs without interrupting the process. Various other installations are in hand, including one for cleaning iron blast-furnace gases at the works of the Bethlehem Steel Co.; we may here mention that the late Mr. B. H. Thwaite, the first to generate power from blast-furnace gases in gas engines, made a number of experiments with the object of cleaning the gases by means of electrical precipitation many years ago. Several companies have purchased licences to use the Research Corporation's processes, and the success already attained with a small staff has enlarged the resources of the Corporation, which has thus been enabled to engage a larger staff and create special departments to deal with the various classes of conditions. The original stockholders have been repaid, and the Corporation has nearly £30,000 in hand. Mr. Bradley gave a long list of industries to which the application of the process was pending or in operation, and touched upon many points which we have not space to deal with here. His paper, to which a bibliography is appended, will rank as a classic in this comparatively new branch of electrotechnics.

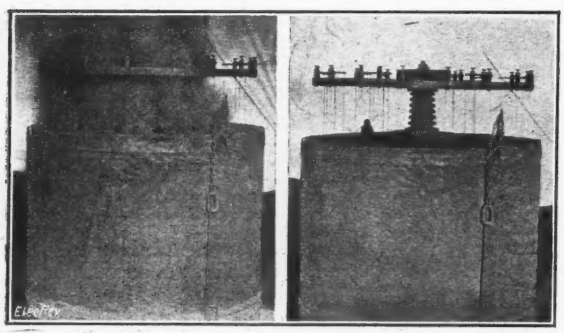


Fig. 6.—Top of Precipitator. Pressure Off.

Fig. 7.—One Second after Closing the Circuit.

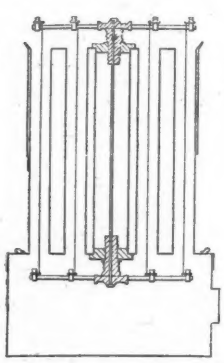


Fig. 8.—Section of Strong-Nesbit Precipitation Chamber.

Another paper on the subject was contributed by Prof. A. F. Nesbit, who approached it from the theoretical and experimental side, showing that the particles suspended in a gaseous medium, when subjected to the action of intense electric fields, became charged by the action of the travelling ions and electrons, and consequently tended to travel along with these ionic streams.

Electrical precipitation takes place on an enormous scale in Nature—the downfall of rain after a flash of lightning is a familiar example.

A negative ion is formed when a neutral molecule of a material substance has imparted to it from any source one or more electrons in excess of the number contained in its neutral state; similarly a positive ion is formed when one or more electrons are removed from a neutral molecule.

These ions may become the centres or nuclei about which large aggregates of particles may be clustered. Ionisation may be produced by high temperatures, chemical action, the electric field, and other agencies.

The author described a precipitator designed by Dr. Strong and himself, consisting of groups of 25 pipes 4 ft. long and 5 in. in diameter, through which fine wires were stretched, as shown in fig. 8. Figs 6 and 7 show the appearance of the top of the apparatus when 900 cb. ft. of coal smoke was moving through it per minute at a velocity of about 5 ft. per second. The instantaneous change produced by the electric field is striking.

The author stated that the action of the precipitator was due to the corona discharge from the electrodes. When the wires were positively charged, the corona appeared to occupy nearly the whole cross-section of the pipes; when the wires were negative, the coronas round them were only a few millimetres in radial depth. It was found that an alternating corona precipitated about 50 per cent. of the suspended matter; the positive corona deposited 70 to 80 per cent., and the negative 95 to 98 per cent. The inefficiency of the alternating current was due to the reversal of polarity of the active electrode, and therefore of the motion of the electrons and ions. With hot air passing through the pipes and a negative corona the breakdown voltage was about 32,000 volts; with cold air the voltage was slightly greater, and with a positive corona the voltage was less in both cases. The breakdown voltage was about the same for cold smoke as for cold air, but with hot smoke the voltage had to be decreased to 28,000 volts. There was but little deposit on the electrodes, and such deposit could be dislodged by the momentary application of a disruptive discharge.

Prof. Nesbit pointed out that the process not only precipitated carbon from smoke, but also ash, which could not be eliminated from the flue gases by the most efficient stoking. The cleaning of producer and blast-furnace gases offered an important field for the system.

LARGE ELECTRIC FURNACE FOR ROUTINE FOUNDRY WORK.

[COMMUNICATED.]

There is, among many engineers, a tendency to regard electric steel furnaces as a luxury—capable, it may be, of producing and refining limited quantities of high-grade tool steel and other superfine products, but economically impracticable for ordinary foundry work. With large and highly efficient turbo-units, such as are now to be found in all our large industrial centres, this presumed limitation of the utility of electric furnaces cannot be justified. A number of electric furnaces are already in use in Sheffield and other steelworking centres, and important additions are frequently being made to their number, but, with the exception of a few installations described in these columns during recent years, little information has been published concerning British experience in this field. It has been suggested repeatedly that electric furnaces cannot compete with other types in melting large charges, and it is, therefore, specially interesting to note that in the Otis Foundry, at Buffalo, a 3-ton electric furnace is in operation, melting and working up 54 tons of steel per six-day week. This furnace represents a serious attempt to make electric steel castings on a scale comparable with open-hearth practice, and so successful has it proved that, after only six months' operation, it has been decided to put in a second furnace of equal capacity. Energy is taken from Niagara, but the secret of successful operation does not lie in this fact. Unfortunately, the actual price paid for energy is at present withheld, though it is interesting to note that a considerable reduction in rate is allowed in consideration of the furnace being operated only between 7 p.m. and 6 a.m., the day staff being

engaged solely in moulding. It is stated, however, that the furnace consumes 655 KW. for two hours at a time, and averages 64,000 KW.-hours per month. From this information it is easy to see that abnormally cheap energy is not at the root of the furnace's success. In Sheffield a number of electric furnaces are supplied at 0·33d. per KW.-hour, but even assuming 0·5d. as an easily obtainable power tariff, the Otis furnace would cost 0·5d. × 64,000 × 12 = £1,600 per annum to supply on this flat rate. The equivalent charge per horse-power demand (the usual basis for bulk supply from Niagara) would be £1 16s. per H.P.-year, and it is not probable that anything like so low a rate is obtained even under the limited-hour agreement. In other words, electrical supply in steel-working centres in this country is cheap enough to permit equally satisfactory operation for general foundry purposes of such electric furnaces as that now described.

Energy is taken at 2,200 volts three-phase and transformed by two Scott-connected transformers to 220 volts single-phase, which is further reduced by ohmic losses to 195 volts net, across the arc. The furnace is of the Snyder tilting type, built of riveted steel plate and lined with silica brick. The bottom is of silica sand, and the domed roof is of silica bricks carried in a detachable cast-steel ring, and has a life of 150 to 175 heats (four to six weeks). Two spare roofs are kept ready for use, only two or three hours being occupied in replacing one that is burnt through. The total cost of linings and repairs averages less than 2s. 6d. per ton of steel.

A single 6-in. graphite electrode passes through the roof and costs about 2s. 10d. per ton of steel to maintain. This cost and the cost of linings and repairs compare very favourably with figures quoted in this country. Current is taken through the bottom of the furnace bed by a steel casting, the lower end of which is water cooled to protect the copper connections, while the solid upper end melts flush with the lining and is covered at the end of each shift, before the slag has "set" over it, by a steel plug which displaces the slag and leaves the contact sufficiently clean for current to pass at once, when the furnace is next placed in commission.

A factor which contributes very materially to the overall economy of the furnace is the possibility of using up machine shop borings and turnings. These have a scrap value of only 20s. or so per ton, and cannot be dealt with satisfactorily in open-hearth furnaces. The charge used is 70 per cent. of such turnings and 30 per cent. foundry scrap, risers and headings, &c. The larger pieces are charged first, and the fine material piled on top up to or above the charging door. The main switches being closed, the electrode is lowered and regulated by hand (under guidance of watt-meter indications) for 10 or 15 minutes, after which the furnace is self-regulating through a ratchet and rack and pinion gear. The turnings used are very rusty, hence charcoal is added for reducing purposes; thereafter procedure is practically as in standard open-hearth work, ferro-silicon or ferro-manganese being added towards the end of the heat. The castings to be made include electric motor frames and general elevator parts, typical analyses being as follows:—

	For motor frames.	For general castings.
Combined carbon	0·18—0·2	0·18—0·2
Silicon	0·45—0·5	0·35—0·4
Manganese	0·1	0·4 —0·45
Phosphorus	0·075	0·075
Sulphur	0·05	0·05

Slag is made sticky and drawn out before pouring by iron rabble hooks. Moulding sand is charged towards the end of the heat if needed to thicken the slag. Rack and pinion tilting gear driven by a 5-H.P. motor is installed below floor level, and is operated from a drum controller behind a sheet steel screen opposite the pouring spout.

Four heats, aggregating nine tons, are run off during each night shift. The first melt occupies two and a half hours and the remaining ones less than two hours each. The normal consumption during these periods is 655 KW., corresponding to a load factor of 30 per cent. during the whole 11-hour shift.

Oxy-acetylene torches are used to trim headings and risers from the castings, and the oxygen for this purpose is manufactured electrolytically, using a 25-KW. motor-generator set consuming 3,300 KW.-hours per month. Most of the foundry machinery and the various cranes are operated electrically, the total electrical consumption being 84,000 units per month, of which 75 per cent. is taken by the electric furnace. With the installation of the second furnace, the night demand of the foundry will rise to close on 1,500 KW., a very acceptable addition to the supply station night load.

AUTOMATIC-LIFT ACCIDENTS.

By FRANK BROADBENT, M.I.E.E., M.Cons.E.

The fatal accident which occurred recently in a well-known London club in connection with an automatic electric lift is one of those occasional reminders that automatic mechanism, no matter how perfect, is not infallible.

The facts of the case, however, show that a failure of the automatic gear to perform its function is, in itself, not sufficient to cause an accident of this kind, but that human oversight is a contributory agent.

The lift is of the kind known as the "full automatic" type serving four floors. The general principle of operation

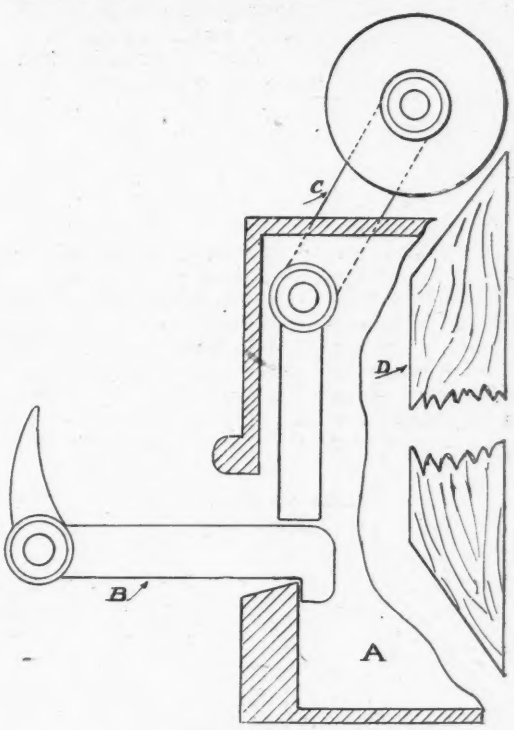


FIG. 1

is briefly the following. On each floor there is a "calling" push which, on being pressed, "calls" the car to the landing. In the car are five pushes, viz, one for each floor, and an emergency "stop" push. On pressing any of the "floor" pushes, the lift automatically travels to and stops at the corresponding landing. Each opening is protected by a collapsible gate provided with an electromagnetic lock, the function of which is to prevent anyone opening the gate unless the car is standing behind it, and to render the lift inoperative when the gate is open. The general principle of such locks is shown in fig. 1, where A is the lock, B the latch, and C the lever operated by the car. Usually the apparatus is self-locking, that is to say, the locking lever is dropped by means of a spring or weight as soon as it is released by the car. The lever carries a roller on its free end, which engages with an inclined plane or striker D fixed on the side of the car. As the car passes a landing the striker lifts the lever, thus releasing the lock and permitting the gate to be opened. If anyone tries to open a

gate when the car is above or below it, he is unable to do so; but if he pulls against the latch whilst the car is travelling, the gate will open as the car passes it. The opening of the gate stops the lift, as the lock is electrical as well as mechanical, and the withdrawal of the latch breaks the electrical contacts which are connected in series with the stopping circuit.

This is somewhat of a disadvantage as the lock, although it contains contacts, is not intended to be used as a switch to break the circuit. Not only do we run the risk of burning the contacts by so doing, but also of causing arcing from one to the other or over to the case, particularly on circuits of 400 volts and over.

If the contacts fail to break the circuit when the gate is opened in the manner described, due either to their failing to separate, or to arcing over and maintaining an arc, or to being temporarily short circuited, the car continues to travel with the landing gate open. In these circumstances one of the following accidents may happen. The person who opened the gate may lose his balance and fall down the lift well; or, some one may fall out of the car on to the landing; or, some one may, expecting the car to stop, try to step out and get crushed between the landing and the car. All these are possibilities more or less remote, but possibilities nevertheless.

On the mechanical side there is the possibility that when the gate is shut and the car leaves the landing, the latch is not securely held. This may occur by reason of the locking lever not falling properly, due to some obstruction or to stiffness. In some cases even a piece of paper falling down the well and lodging between the lever and the framework might cause this; stiffness due to dirt or rust may be sufficient to hold the lever up; or the gate may ride up on dirt in the bottom track and cause the latch to foul the locking mechanism. If the lock fails to fasten the latch securely, the gate can be opened when the car in not behind it.

In the case referred to it is not possible to state precisely what happened, as the member of the club who unfortunately lost his life lived only for an hour or two after the accident, and never regained consciousness; and there were no eye witnesses who actually saw him open the gate. It is clear, however, that he opened the gate on the ground floor when the car was on the first floor, and fell down the lift well. On inspecting the lift on behalf of the club a few hours after the accident, I endeavoured to open the same gate when the car was not behind it, but after repeated trials, and using considerable force I was unable to do so. Thinking that there might be a sort of half-cock position in which the locking piece rested against the edge of the latch, I had the cover of the lock taken off and attempted to set the mechanism in such a position that whilst making electrical contact the latch could be lifted and the gate opened. In this I was unsuccessful.

I then tried the basement gate and found that after several attempts I could lift the latch. This gate, however, had been forced open a little while previously in order to extricate the unfortunate gentleman who fell down.

Whilst I was attempting to open the first floor gate with the car at the second floor, a member succeeded after several attempts in opening the ground floor gate, and called me down. On closing the gate I was able to open it again once, but after that failed to do so.

From this it would appear that there must be some position of the locking gear, which occurs probably once in a dozen times, in which the latch can be lifted when the lock is not released by the car. Assuming that one person in a hundred attempts to open a lift gate when the car is not there, and that once in 10 operations the lock does not secure itself properly, the chances of the gate being improperly opened are fairly remote.

In a case of emergency it must be possible to open a gate in some way or other, and anyone who is conversant with the mechanism of the lock can do so. In many cases, as in the lift in question, all that is necessary is to put one's arm through between the bars of the gate and lift the lever, performing in fact the same function as the car would do in arriving at or passing the floor. There is then the possibility that, after opening a gate in this way, sufficient care is not taken to ensure that the gate is properly closed and secured before leaving it. Should this occur, the gate forms practically a trap for any person who comes along to use the lift, as in the event of his failing to note that the car was not at the landing, he would open the gate and step forward, possibly realising too late that he had made a mistake.

In factories such lifts are now in common use, and the workmen and factory lads very soon get to know how to open the gates. It is, in fact, not an uncommon thing for mischievous boys to slightly open one of the gates deliberately after watching the car pass to a remote floor. It is only necessary to open it a fraction of an inch in order to put the lift out of action. Another favourite trick of a man who wants to use the lift, and is not sure that it will stop at his landing, is to stand with his finger on the latch waiting for the car to pass. As soon as it reaches his landing the gate is unlocked and open it comes, stopping the lift, (assuming there is no fault in the electrical circuit).

Here, then, are two points capable of improvement. The first danger can be considerably lessened by placing the lock-releasing mechanism near the top of the gate, where it is not so easy to tamper with it. The gate must, of course, only be unlocked when the car is approximately at the landing level, and this is quite easily arranged.

The other weak point, namely, the ability to open the gate as the car is passing, is not so easily remedied, particularly in what are called semi-automatic lifts, in which some form of cage switch is used, as in this case the floor to which the lift is travelling is not selected until the car actually arrives at its destination. In the case of a full automatic lift in which the floor is selected as soon as the push-button is pressed, it would be possible to electrically interlock all the gates until the car had arrived at its destination. This, of course, introduces an additional complication, but in the interests of safety, particularly in factories where large numbers of men use these lifts, it may be considered worth while to add it. On the other hand, the less complicated the gear is the better, because, if it repeatedly gives trouble, the time comes when the engineer or electrician in charge will short-circuit or cut-out of action the cause of trouble, until he has time to attend to it properly, and, under these conditions, the whole lift is rendered unsafe. Moreover, these temporary jobs generally acquire a semi-permanent character.

As already mentioned, the possibility of accident is very remote, considering the number of journeys which a lift makes per day, and it is no doubt on account of the very small number of failures, taken as a percentage of the total number of journeys made by the lift, that one is apt to forget the possibility of accidents occurring, and to omit to take ordinary precautions.

The Nature of the Ultimate Magnetic Particle.—In a letter under this title to our contemporary *Science*, Messrs. K. T. Compton and E. A. Trousdale point out that for many years scientists have agreed in ascribing the magnetic properties of bodies to the action of exceedingly small elementary magnets, but the nature of these ultimate magnetic particles has been an open question. The influence of temperature, chemical composition and other factors has received the simplest explanation on the theory that molecules, or possibly groups of molecules, are the ultimate magnetic particles. On the other hand, the electron theory of magnetism seems logically sound, and is the only theory which has successfully accounted for diamagnetism.

The recently developed method of determining the positions of atoms within a crystal by X-ray photography, and the ferro-magnetic properties of magnetite, hematite and pyrrhotite crystals, suggested a direct experimental method of eliminating one or the other of these two theories. By comparing photographs taken through these crystals while magnetised and unmagnetised, it can be determined with certainty whether or not the atoms have moved from their positions of equilibrium during the process of magnetisation. The authors have obtained experimental results with magnetite and hematite which indicate that the atoms do not leave their positions of equilibrium during magnetisation. These results are consistent with the electron theory of magnetism and prove conclusively that magnetism is not a molecular phenomenon.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Engineering Industry and the War.

Your issue of Friday last contains a letter from Mr. J. S. Warner, two paragraphs of which appear to me a gratuitous gibe at the medical profession, as unwarranted as it is irrelevant to the subject of that queerly worded lucubration. Mr. Warner says: "Try any medical man you like, and he does not know that the average female heart pumps blood as 3 is to 5 of the average male, &c." .... Well, why should he? The facts as far as they were taught when I studied physiology are as follows: Weight of the heart (male): 266 to 346 grammes, average 312 grammes, = 1 : 169 total weight of body. Weight of the heart (female): 230 to 340, average 274, = 1 : 162 of total weight of body (Piersol). (Rouvière gives 275 as the average weight for both sexes—Precis d'anatomie, 1913.)* Mass of blood $\frac{1}{13}$ to $\frac{1}{15}$ of total weight of body (Arthur). Mass of blood propelled by the heart into the aorta during each contraction = $\frac{1}{30}$ of the total, *e.g.*, for a human being weighing 78 kg., containing 6 litres of blood, 6,000/30 = 200 ob. cm.

Thus, Mr. Warner's figures would apply in the case of a man and a woman whose relative weights would be as 5 is to 3, and only then. What of the old tag: *sutor ne supra crepidam?*

H. L. J.

London, S.W., *May 8th*, 1915.

* Rouvière's figures apply more particularly to French cases; Hutchinson's weight tables take the height into consideration without regard to sex, so does the old formula—

$$\frac{H'' G''}{17} = \text{W lb.} \left(\frac{\text{Height} \times \text{girth}}{17} = \text{weight.} \right)$$

Cab Signalling.

I hope you will allow me space in your valuable paper to contradict some of the statements that Mr. Acfield makes in the article appearing in your editions of the 16th and 23rd ult.

The notion that a cab signal should be audible only has often been shown to be both wrong and dangerous. No valid reason against making the cab signals both visual and audible has, as yet, been given in any of the many articles I have read on this important subject. The only "reason" I have ever seen advanced is the statement that the visual indication, notwithstanding the audible one, would take the driver's eyes off the track, and thus imperil the train. But this "reason" has been so often and so conclusively shown to be wrong, that I shall not ask for space here to repeat the proof against it.

Mr. Acfield attaches relatively undue importance to the distant cab signal indicators. He certainly must know that no distant cab signal, however satisfactory as a distant indication, could have been any good to the driver and fireman at the instant they both missed the *home* signal at Bromford Bridge. The Great Western distant cab signal did not prevent, and could not have prevented, the wreck at Reading, and would have been equally useless at Cannon Street.

Of all the cab signals that have come before the public, the only ones worthy of adoption, or test, are those which give indications that are both visual and audible, which plainly differentiate between clear, run slow, and stop, and which are controlled by means of electrical contact with ramps.

This fact has become so widely known that it is surprising to find that one in Mr. Acfield's position is still unaware of it.

Amos Ogden, M.I.M.E.

Derby, *May 9th*, 1915.

P.S.—The Mr. Acfield referred to is of the Midland Railway.

The War and Future Trade.

I quote from your leading article entitled "The War and Future Trade," which appears in your issue of May 7th. You write:—

"It becomes more and more obvious as we study the problems of peace, even as superficially as is possible at this date, that that stage of this world conflagration will be only slightly less difficult than are our vast and unprecedented naval and military operations. . . . . We trust that Mr. Runciman will recognise the need that exists for a measure of modernisation and organisation with certain supplementary alterations making for greater efficiency and usefulness, supposing that he cannot see his way to adopt the proposals that are being again advanced in some of the more ambitious schemes that have been put before him by critics and advisers."

The correspondence that appeared in the *Times* in the summer of 1908, entitled the "Electrical Industry" dealt, I think, with very much the same problems as those to which your leading article refers. The minds of many of us were occupied then as they are to-day—almost exactly seven years later—in endeavouring to find a solution of the difficulty of "industrial organisation."

In the month of July of that year I myself addressed a somewhat lengthy letter to the *Times*, suggesting that a Committee or organisation of business men should be formed in the City of London, with the object of attempting to study the disease from which I at the time felt that British commerce was suffering due to German competition, and I pointed out that it was hopeless to endeavour to prescribe a remedy before one had diagnosed the malady.

I find myself seven years afterwards, with experience behind me, still writing, still talking, still trying to induce those connected with our industry as well as other business men in the City of London to believe that if we are to assure success in war or peace we must not be ashamed to learn from our errors in the past.

Lord Selborne, in his letter to the *Times* of to-day, pleads with much emphasis for national organisation. Mr. Bonar Law, in his speech in the House of Commons yesterday, argued upon much the same lines, but we still go on talking and writing and nothing is done. The fact is, I believe, that we do not know where to commence.

To those members of our industry who are interested in this subject I would, therefore, make the following appeal, viz., that they should at once communicate with the Secretary of the London Chamber of Commerce, 97, Cannon Street, E.C., intimating that they would be prepared to attend a meeting, if called, for the purpose of endeavouring to solve the many intricate industrial and commercial problems arising out of this war. I have reason to believe that the London Chamber of Commerce is ready and willing to assist us to build the foundations of such an organisation as that for which everyone seems to see the need.

Edward Bergtheil.

London, E.C., *May 11th*, 1915.

[We shall gladly welcome the views of our readers respecting our correspondent's suggestion. We, of course, heartily support his proposal for a conference of the electrical industry, for we ourselves advocated it in our issue of October 16th last, page 514. —EDS. ELEC. REV.]

PARLIAMENTARY.

Electric Railways (Facilities) Bill.—On Tuesday the Examiners had before them a late Bill to authorise the City and South London Railway Co., the Central London Railway Co., the London Electric Railway Co., and the Metropolitan District Railway Co., or any of them, to make agreements with each other, and the London General Omnibus Co., for the purpose of providing increased facilities for the interchange and alternative routing of traffic, the application of receipts, and the appointment of a Joint Committee. Owing to the late notices, the Standing Orders of the House had not been complied with, and the Bill will go before the Standing Orders Committee, who will decide whether it shall be allowed to proceed.

Lincoln Corporation Bill.—A Select Committee of the House of Commons, presided over by Mr. Middlebrook, has considered the Lincoln Corporation Bill, which, amongst other things, provides for an extension of the electric generating station, and gives power to run trolley vehicles. Mr. S. Clegg, electrical engineer and tramways manager, gave evidence with regard to the extension of the station. The cost of the station was estimated at £36,260 exclusive of the land. There was no opposition, and the clause was passed. Mr. Forbes Lankester, K.C., explained the proposals with regard to railless traction, to which there was no opposition. What was proposed was practically a through route from east to west, on the lower level of the city. This part of the Bill was also ordered to go forward.

Plymouth Corporation Bill.—Lord Newton's Committee of the House of Lords on Tuesday concluded the consideration of the Bill of the Plymouth Corporation, which consolidated the Acts of Plymouth, Devonport, and East Stoneham, as the result of the amalgamation. The Bill covered 240 printed pages. A large number of clauses regulating the electricity and tramway undertakings were passed without any opposition.

Irish Electric Lighting Orders.—On Tuesday, No. 1 Electric Lighting Provisional Order Bill was ordered by the Examiners to go for first reading. The Bill confirms electric lighting orders granted by the Board of Trade to the Rural District Council of Clifden, Galway, and to the Urban District Council of Enniscorthy.

Electric Lighting Provisional Order (No. 2) Bill.—This Bill was ordered by the Examiners on Tuesday to go for third reading. It confirms electric lighting orders to the following local bodies:—Haworth U.D.C., Irlam U.D.C., Hull Corporation (Extension), Knaresborough U.D.C., Normanton U.D.C., Litherland U.D.C., Normanton U.D.C., Ryde Corporation (Amendment of Order), Shipton U.D.C., Stanley (Order granted to the Electrical Distribution of Yorkshire, Ltd.) and Tenby Corporation.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

B.T.H. Loom Motors.

The extended adoption of electricity for the individual drive of textile machinery has led to great advances in the design of simple induction motors for this purpose. These machines are totally enclosed and dust-proof, to meet the conditions prevailing in the mills, and usually run on three-phase circuits, with no regulating or starting apparatus other than a switch. For driving looms the motors are hinged to base-plates, with springs to control the belt tension and to facilitate smooth starting and running, as shown

FIG. 1.—B.T.H. A.C. LOOM MOTOR.

in fig. 1, which represents a new line of loom motors recently brought out by the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby. The rotor has a squirrel-cage winding and runs in ball bearings, which are carried in solid end-shields; the base-plate is slotted to provide for adjustment if the belt stretches. The stator punchings are firmly clamped between cast-iron flanges, and are directly exposed to the air. As the motor is frequently stopped and started, the rotor is designed to have small inertia, and a special loom motor switch has been developed by the B.T.H. Co., of the drum controller type, giving two long breaks on each phase, with renewable contacts. The motors vary in size from ¼ to 1½ H.P.

Witton Tramway Sectioning Switch.

At the request of a large municipality, the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., has constructed a sectioning switch for pole mounting on the tramway circuits, which consists of a 300-ampere "Peel" switch fixed in a cast-iron case, the case being of such a length that the switch can be fully opened and the lid closed. The lid is provided with a spring lock

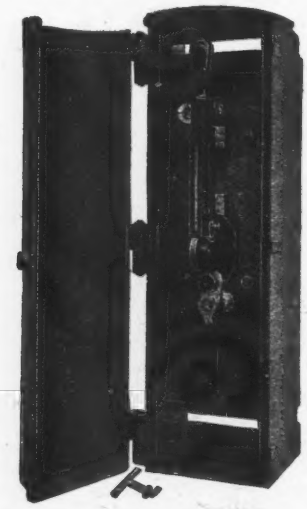


FIG. 2.—WITTON 300-AMP. TRAMWAY SECTIONING SWITCH.

and a special key. The sides of the switch case extend some distance beyond the back and fit on to the pole, to which the case is clamped by two steel bands, the ends of which are screwed and provided with nuts and washers.

Spring Inspection Fitting.

THE STEEL TUBES AND CONDUITS CO., of Alice Street Works, Keighley, are now making a new inspection elbow and tee for conduit work, called the "Spring" inspection fitting, which they have patented. The advantages of these fittings are that they give more room to inspect and work in, the lid can be prized off quickly, and to refix it, it is only necessary to press it on again. If

FIG. 3.—INSPECTION ELBOW AND COVER.

the lid is not perfectly tight a slight pressure of finger and thumb on the lugs will adjust it. It is also very neat, and its price represents a great saving on the older patterns. The firm will be glad to give full particulars to anyone interested.

LEGAL.

ATWELL *v.* WEST HAM CORPORATION.

ON May 5th, at the Bow County Court, before Judge Smyley and a jury, a case was opened in which Mr. A. E. Atwell, a former employé of the West Ham Corporation Electricity Department, claimed damages for injuries received from an electric shock, in April, 1914.

WHITTAKER *v.* L.C.C.

IN a Divisional Court of the King's Bench Division Justices Lawrence and Bailhache heard the plaintiff's appeal in the case from the decision of Judge Harrington at the Wandsworth County Court.

MR. MCCALL, K.C., said the action was brought to recover damages for injuries sustained by the plaintiff through being ejected last September from one of the defendants' tramcars. It was admitted that the plaintiff was lawfully in the tramcar, having paid for his ticket, and he was ejected before he reached the point covered by his ticket. At the trial certain questions were put to the jury, and they were answered in favour of the plaintiff. The judge entered judgment in favour of the defendants on the ground that as the act of the conductor was illegal and would have been illegal if the defendants had done it themselves, therefore, the defendants were not liable. The plaintiff got into the car at Wandsworth High Street and took a ticket for Earlsfield Station. Before the car reached Tooting the conductor accused him of taking a penny journey for a halfpenny ticket. Plaintiff said he was going to Earlsfield Station, and that he had paid a penny for his ticket. The conductor told him to leave the car, and summoned the driver. Plaintiff was hustled off his seat and pushed out of the car. He fell in the street and injured his ankle.

The jury found that the plaintiff was ejected from the car; that he was not intoxicated; that the conductor did not think he was intoxicated; that he was ejected on the ground that the conductor thought he was endeavouring to travel to a point beyond that to which his ticket carried him; that the injury to his leg was the result; and they gave him £30 damages and found that plaintiff was not ejected through the malice or spite of the conductor. Counsel submitted that on these findings it was clear that the plaintiff was entitled to judgment.

MR. CRAIG HENDERSON, for the L.C.C., submitted that the conductor ejected the plaintiff on the ground that he was committing a fraudulent offence. If his employers had been present in person the only remedy they could have adopted was to ask for the plaintiff's name and address. The conductor did not do that, but promptly ejected him from the car and that was outside the scope of his authority, and the defendants could not be held liable. If the jury had found that the plaintiff was intoxicated there would have been no case for the Council. The power to eject a person was limited to a case where a man was intoxicated.

MR. JUSTICE LAWRENCE: Suppose a sober man smashes a window and says he is going to smash the lot, what must the conductor do?—He must call a policeman.

MR. JUSTICE LAWRENCE: Then he can smash all the windows and you cannot turn him out.

MR. JUSTICE BAILHACHE: Suppose two persons begin to fight in a car, you are going to leave them there?

MR. HENDERSON: They are committing an offence against the by-laws and their names have to be taken.

MR. JUSTICE BAILHACHE: That is impracticable; the men are busy.

In giving judgment, MR. JUSTICE LAWRENCE said that if a person travelled beyond the distance provided for by his ticket it was a form of trespass, and unless the company had authority to remove him the authority of the Council would be rendered ridiculous, and they would not be able to protect their own property. The act of the conductor was wrongful, and the plaintiff had a right to sue. Judgment ought to have been entered for the plaintiff in accordance with the jury's findings.

MR. JUSTICE BAILHACHE concurred, and judgment was given for the appellant accordingly with costs.

London Tube Railway Compensation Claims.

Mr. H. Chatfeild Clarke, president of the Surveyors' Institution, has given his awards in the proceedings which he conducted as Arbitrator between the London County Council and the London Electric Railway Co., in compensation claims relative to several easements and land for tube railways.

In the claim for the staircase built under the premises, Nos. 1 and 3, Oxford Street, measuring 45 ft. × 11 ft., and connecting the Charing Cross, Euston and Hampstead Railway Station with the Central London Railway, the actual area taken was 484 ft., and Mr. Howard Martin, for the L.C.C., on the basis of 10 per cent. of the surface value, £6 per ft., brought out the compensation at £290, to which he added 10 per cent. for forced sale, making £319. The land on the surface was, he said, worth £2,904. The railway company's expert witnesses, Mr. Leslie Vigers and Mr. Douglas Young, presented valuations of £44 and £36 respectively, being based on £1 per foot run reduced to lineal feet.

The second claim related to a total area of 11,640 ft. at Kingsway and Aldwych Island, part of a site of 120,000 ft., under which a tube ran at a depth of 88 ft. The site was stated by Mr. E. Morten, K.C. (for the L.C.C.) to be an exceptional one worth about £1,300,000, with a rental value of £50,000 a year. Mr. F. W. Hunt, chief assistant valuer to the L.C.C., gave evidence that the whole site would be damaged 1 per cent. of its total capital value, or £13,000, equal to a difference of three months' rental, or 10 per cent. of the part affected for surface value. For the railway company, Mr. Vigers and Mr. Douglas Young gave valuations for compensation amounting to £901. The latter characterised as extraordinary the statement that the presence of the tube depreciated the whole of the site.

The third claim involved the question of the easement under the Shaftesbury Memorial Fountain, Piccadilly Circus. The easement was 36 ft. in length, and compensation was claimed at £1 per ft.-run, £36. The property around was acquired by the Metropolitan Board of Works in 1889, and the railway company's experts contended that the rate was settled by the Crown in 1890 at 2s. per ft.-run, which for 40 ft. came to £4.

The Arbitrator has awarded the following amounts:—For Nos. 1 and 3, Oxford Street, £175; Kingsway and Aldwych Island, £1,355; and Piccadilly Circus Fountain, £40. An award of £195 was made in respect of an easement under Southampton Row, between Vernon Street and High Holborn, subject to the surface area being in a street within the London Electric Railway Act, 1906, Sec. 59; and of £80 for an easement under the pier and stage at Victoria Embankment.

Nicholls *v.* Astley & Barwell.

In the Lord Mayor's Court, last week, before the Common Serjeant (Sir F. Bosanquet, K.C.), and a jury, a claim was made by Messrs. R. Nicholls & Son, electrical engineers, 54, Basinghall Street, E.C., against Messrs. Astley & Barwell, dressmakers, 385, Holloway Road, for £29 2s. 1d. for electrical fittings supplied and work done in installing electric light in the defendants' premises. The plaintiffs' case was that an order was given by Mr. H. Astley, a brother of one of the defendants, who were two ladies carrying on an extensive dressmaking business. The plaintiffs, after making the necessary inquiries, proceeded to do the work, and upon completing the wiring of the premises on May 27th required payment on account. Mr. H. Astley had promised to get a cheque for £10 or £12. On June 3rd a payment of £3 was made. The plaintiffs were dissatisfied with the payment and sent their workman to bring away the tools. In consequence of a message sent by the workman that a substantial payment would be made the work was proceeded with. When it was completed and the defendants applied for payment of the account, a letter was received from Astley saying that the plaintiffs' account had been forwarded to him as the job had been carried out for him.

The plaintiffs in their evidence, said at the time the order was given by Astley there was already an indebtedness owing by that party which was being paid off by instalments. The work had been done for the defendants and not for Astley.

For the defence Mr. H. Astley, a builder and decorator, was called, and he said that the work of fitting up his sister's premises in Holloway Road was given to him, and he employed the plaintiffs, who agreed to carry out the work. The money which the plaintiffs had received on account was money he had paid out of his own funds. The plaintiffs had not rendered an account to him, and, therefore, he could not render the bill to his sister's firm. As soon as he did so he would receive payment, and the plaintiffs' account would be settled.

The jury found a verdict for the plaintiffs for the amount claimed, and judgment was entered accordingly.

Trading with the Enemy.

In the City of London Court, on May 10th, before his Honour Judge Atherley-Jones, K.C., Mr. Otto Bohndel, trading as Schoen Bros., 29, Cock Lane, Snow Hill, sued Messrs. H. A. Jones & Co., electricians, 171, Holland Road, Shepherd's Bush, for £19 1s. 2d. for electrical goods supplied.

Mr. Jones said he admitted that the claim was due, but he dare not pay it, because the plaintiff was a German.

Mr. Harry Strouts, plaintiff's solicitor, said that the plaintiff was a registered German. He had been carrying on business in London for 10 years.

Defendant: He is a German agent for the sale of foreign goods.

Plaintiff's traveller, A. J. Conway, who said he was an Englishman, said that the plaintiff was not naturalised.

The Judge: Is he interned?

Plaintiff's Traveller said he was not.

Defendant: His brother is.

Conway added that plaintiff bought all his goods from various German houses, and paid for them outright. Some of them were made in Germany. The goods were invoiced to the plaintiff.

Defendant: These are all German goods, especially cable and torchlights. I am trading with the enemy. He is a pure German.

Conway: Two-thirds of the goods are German.

Defendant said that owing to the war his business was ruined, but next week he meant to join the Army.

Judge Atherley-Jones said he must give judgment for the plaintiff. The law was clear, but whether it was the right law was not for him to say. An enemy alien carrying on business in this country was able to enforce any contract which he entered into, and plaintiff was in that position. He might be as great an alien enemy as he liked, but while a benevolent Government left him at large—

Defendant: God help us!

The Judge (continuing), he is able to carry on his trade and enforce his contracts, enforcing payments against British subjects. While I must give judgment for the amount claimed, it will be without costs as defendant had reasonable grounds for raising the question of the alien enemy. I will allow the Court fees.

Defendant: He is ashamed to put his foot into this Court.

WAR ITEMS.

As Others see us!—A New York dispatch to the *Evening News* quotes from *Collier's Weekly* some extracts from a series of articles on Germany contributed by Mr. Albert Beveridge, former U.S.A. Senator, who interviewed the Kaiser, leading savants, industrial magnates, and others in Germany. Herr Walther Rathenau, of the A.E.G., whose name and views are not unfamiliar to our readers, expressed himself in the following terms:—

"In considering the causes of the war, we must distinguish between powder and matches. The match that fired the powder was Russia. But the powder was the inevitable conflict between England and Germany. On the surface this is a mere struggle for commercial monopoly on England's part. But deeper down it is a struggle between two conceptions of life and duty. Take the chemical industry. There, 5,000 scientists, Germans, are glad to work for just a livelihood. Their real reward is their passion to discover Nature's truths. Also, there is their conception of duty. They are not only satisfying themselves by doing for its own sake what they love best to do, but they also feel that they are helping to build up Germany, and in a broader way to increase the sum of human knowledge.

"On the other hand, there are in England, let us say, 30 scientists of the same ability and skill. But they must be professors of Oxford or Cambridge, or other schools of learning. They would scorn employment and work such as our 5,000 scientists do. Here we have the explanation of our superiority. Among us the love of knowledge is part of the German character. We feel we cannot have too much of it. To make it plainer, let me say that in Germany it is fashionable to be well informed. In England, on the contrary, it is felt that it is ungentlemanly to acquire more knowledge after a certain point of education. 'Englishmen say they dislike 'walking dictionaries.' Apply the idea of duty to one's country to employés of industry—say an industrial company of 30,000 employés, or a great bank with 10,000 employés willing to work, not for food only, but also as a matter of duty for the building up of Germany. Contrast with this conception of life and labour the conception of the same class of men in England; as little work as possible, no more knowledge than is absolutely necessary, vacations, luxuries, and the mental and physical habits growing out of the same. These illustrations show why Germany has been able to sell her products in the foreign markets which England monopolised for so long. She thought they belonged to her as a matter of right. Conflict was inevitable. It is a difference of fundamental ideals of life and duty. That is the deep reason why the war must go on until it is proved which of these ideals is the true one. That is why we Germans are willing to die and suffer worse than death in order to win."

Petrograd Electric Lighting Co.—A certain amount of interest is attached to the report for 1914 of the Petrograd Electric Lighting Co. of 1886, in consequence of the threatened sequestration of the undertaking, as mentioned in this journal on several recent occasions, by the Russian Government on the ground of the company being, as is alleged, almost entirely owned and controlled by Germans. As now announced from Petrograd, the company's accounts for 1914 show net profits, on a rough conversion of roubles into sterling, amounting to £683,871, as compared with £603,569 in the preceding year, the figures representing the proceeds realised by the works in Petrograd and Moscow for the whole of the year, and those from the works at Loĉz down to August 31st, as the directors have been without connection with the latter city since the date in question. It is proposed to place £33,900 to the reserve fund, as against £31,500 in 1913, to devote £142,500 to depreciation, as contrasted with £132,500, to pay a dividend of 11 per cent.

on the £900,000 of preference capital, as in the previous year, 8 per cent. on ordinary shares of £3,100,000 as in 1913, and 4 per cent. on £1,000,000 of new ordinary shares which were issued in 1914. In addition the taxes on capital and net profits absorb £70,000, benevolent funds £21,500, and directors' fees £21,436, the small balance remaining to be carried forward. It is, however, not intended to pay the dividends for the time being, but to transfer the sums available for these purposes to a dividend account to be created, and to leave to the directors the decision to fix a future date for the distribution. The latest information in relation to the proposed sequestration of the company is to the effect that the situation has not very materially changed, although no definite statement has been made.

A lively discussion is proceeding in the Petrograd Town Council on the question of buying up the electrical concessions in the town, including the business of the famous 1886 company. Opinions are sharply divided on the advisability of buying up all the electrical concerns, or only that of the 1886 company. Councillor Oppel insisted on the necessity of buying the electrical concerns in the near future. Both industry and private consumers, he said, had an interest in their transfer to the town. Technical experts had shown that the transfer of the electrical enterprises to the town would involve increased capital outlay, as it would be necessary to improve the equipment of the electrical stations. At present the stations of all three electrical concerns of the town include in their equipment a considerable quantity of old machinery of comparatively little value. When the moment comes to buy, namely, in 1918, even their auxiliary value will be gone. As to the revenue that may come to the town by exploiting these concerns, accountants value it at 3,000,000 roubles. But such an income is only possible if the price of energy is not reduced. As it must be reduced, the revenue will fall to 1,200,000 roubles. It will increase by-and-by probably, for the lower price will attract new consumers, and extend the field of operations. But in order that the number of consumers should become considerable, the price must be reduced considerably. A slight reduction would not greatly affect the number. In the cost of exploiting the electrical concerns of the town, 70 per cent. goes for fuel; therefore, the town should turn its serious attention to acquiring the cheapest possible fuel for the concerns to be taken over. For the immediate future he thought it would be sufficient to buy out the 1886 company, which would cost the town 22,000,000 roubles, and promised a profit of 2,645,000 roubles. But if all three concerns were bought the cost would be 41,000,000, and the profit would be less. Another councillor thought that the existing town electric stations which supplied the tramways with current should be enlarged to supply current for both lighting and industry. After the town had thoroughly consolidated its position, it would be better able to gather in all the other electrical concerns, and eliminate the private element. Councillor K. Ya. Zagorsky, whose views on the subject have been much discussed, said that Petrograd, like other large towns in Europe, should adopt the single electric station. In order to compete with the companies the town should construct a large power station. He considered it was impossible to formulate a definite plan for exploitation by the town owing to the rapid progress of the electrical business and modifications in its application.

Constantinople Telephone System.—The following circular letter has been issued from Broad Street Avenue, London, E.C., under date May 7th, by Mr. M. Webster Jenkinson, representative in the United Kingdom for the Constantinople Telephone Co.:—

"As possibly you are aware from statements in the Press, the Turkish Government have forcibly taken possession of the company's system in Constantinople. The general manager, Mr. Douglas Watson, and the British staff were expelled from the company's buildings, and on the advice of the American Ambassador left Constantinople, arriving in England last week. I have received a letter from Mr. Salem, the company's chief legal adviser in Constantinople, enclosing minutes describing the confiscation of the plant and property by the Turkish authorities, and a copy of the protest addressed by the Constantinople directors to the Turkish Government. It is hoped that it will soon be possible for the British staff to return, and for the company to resume possession of its plant, and of course endeavour will be made to obtain reparation for the loss inflicted by the action of the Turkish Government. The Turkish authorities have based their action on Article 23 of the Convention, which reads as follows:—

The State have full power to inspect and supervise the service, and the concessionnaire shall do whatever is necessary to facilitate this inspection. The Government also reserves the right to assume control of the service on all or any part of the system when necessary for the public safety. The company shall have no right to demand compensation on this score.

The company has never interpreted this clause as giving the Turkish Government power to take physical possession of the company's plant and to expel the staff as they have done. The matter is receiving the most careful consideration of the European directors, and every possible step has been and will be taken to protect the interests of the shareholders and bondholders."

Italy.—We have received from the British Chamber of Commerce for Italy at Genoa List No. 15 of openings for British articles in Italian markets, from which we make the following extracts. Many of these firms formerly did business with German and Austrian houses and now seek British connections:—

No. 611.—Engineer at Rome requires further agencies for British technical and electrotechnical articles. R.A.D.B.

No. 622.—Commission Agent at Cantania requires electrical material, sunshades, fans. C.G.M.

No. 635.—Engineer at Florence wishes to represent on commission British manufacturer of iron plates, rails, steel, engines, cranes, machinery in general. F.P.P.

No. 639.—Merchants at Turin require fire-clay, china clay for paper mills, pig-iron, foundry articles, fire bricks, alloys. T.P.R.

No 642.—Commission agent at Padova wishes to take up British paints and varnishes, electric lamps, motor-cycles. P.N.

List No. 16, also received, contains the following:—

No. 652.—Commission agents at Turin are anxious to obtain agencies for British electrical machines, belting, oils, &c. T.F.B.

No. 657.—Merchant at Rome would take up British scientific instruments, machinery, electrotechnical material. R.A.O.

No. 664.—Commission agent at Genoa seeks agencies for seamless steel tubes, ship's auxiliary machinery, anchors, chains, machine tools, steel castings. G.F.M.S.

No. 675.—British firm at Rome inquire for addresses of manufacturers of copper and brass tubing, crude oil engines, machinery for flour mills, &c.

Dartford.—Fire Alarms Delayed.—In reply to a request from the Dartford T.C. that Messrs. Stuart & Moore should be allowed to proceed with their contract for the installation of the fire alarms, &c., in the town, the War Office have intimated that the firm (who are engaged on Government work) are in arrear with stores urgently required, and suggest that the Council might possibly see its way to arrange for the work to be carried out by some other firm not engaged on Government orders. The General Purposes Committee is of opinion that it would not be desirable to engage another firm to complete the installation, as suggested, but it is making temporary arrangements pending the completion of the contract.

Government Cable Contract.—Mr. Cecil Beck, in reply to Mr. Booth in the House of Commons, on 6th inst., said Siegfried Hirschmann was still a co-director of the Union Cable Co., but the Office of Works did not know where he was residing. Before the contract was made the First Commissioner of Works asked for the appointment of a supervisor under the Trading with the Enemy Act. Mr. Booth: Can the Office of Works not find out where this man lives, in view of the importance of an enemy getting knowledge of our cable contracts? Mr. Beck: I think you rather misunderstand the situation. The Office of Works has no responsibility beyond seeing that the contract given is carried out.—*Financier.*

We have received the following letter on this subject:—

"I have read the reply given by Mr. Beck, representing the First Commissioner of Works, regarding the contract given to the Union Cable Co., Ltd., in which it is stated that the managing director, Mr. Blackwood, was an Englishman, but the other four directors are Germans.

"I wonder if it has occurred to Mr. Blackwood what every one of us who have any idea of loyalty think of his continuing to hold such a position, and with such associates.

"It is at last beginning to dawn upon us what our enemies are capable of, and I shall be very much surprised if any British workman continues his employment in any business that has a single German, Austrian or Turk connected with it.

"When one raises the cry that the company is German, the palliative is offered—'Oh, yes, but British workmen are employed'—but, I ask, if the Union Cable Co. was closed down to-morrow, are there not other truly British Cable Manufacturing Companies who would gladly give employment to their employés?

"A. R. Munday.

"Dublin, May 11th."

Victoria Falls Staff's Threat.—A Reuter dispatch from Johannesburg says that the majority of the men at the Victoria Falls Power Co.'s works at Brakpan, which supplies power to many mines on the Rand, sent an ultimatum to the manager declaring that unless all naturalised and unnaturalised Germans were discharged they would strike on Wednesday as a protest against the sinking of the *Lusitania*.

Electricity Staff Badges.—The Tonbridge U.D.C. has decided to supply "Public service badges" to the staff of the electricity works.

Board of Trade Publications.—The Board of Trade Commercial Intelligence Branch has issued a list of inquiries for sources of goods for the week ended May 1st.

Personal.—Included in the Committee appointed by Blackburn Chamber of Commerce to assist the Government in the matter of war munitions is Mr. S. J. A. Mills, consulting electrical engineer (Blackburn), and Mr. W. Lupton (chairman), engineer, of Accrington.

In the list of the survivors of the *Lusitania* we are pleased to see the names "Mr. and Mrs. Lines." Mr. S. L. B. Lines, of Toronto, is manager of the Canadian branch of Messrs. Chamberlain & Hookham, Ltd., of Birmingham. He left Canada at very short notice on a business trip to this country, and his wife who accompanied him is interested in Red Cross work. According to the Press reports, Mr. Lines was the last man to leave the ship, he having slid off the deck as the vessel went down. He grasped a raft, and eventually rejoined his wife at the Queen's Hotel, Queenstown. We offer Mr. and Mrs. Lines our hearty congratulations on their escape.

The Sales Engineer at the Walsall electricity works has enlisted for the duration of the war. The Engineer has been authorised to temporarily engage a man ineligible for military service.

Roll of Honour.—Private David Cousin Scott, 1st Royal Scots, was killed in action at Hill 60 on April 22nd. Private Scott in civilian life was an electrician under the Edinburgh Gas Commissioners.

Sergeant Farquhar Kennedy, of the 8th Divisional Signal Company, Royal Engineers, who has been awarded the distinguished conduct medal for showing great courage and resource in maintaining the lines of communication at Neuve Chapelle though exposed to heavy fire, has been for the last 15 years on the telegraph staff of the General Post Office, Glasgow.

BUSINESS NOTES.

Consular Notes.—CHINA.—The American Consul at Chefoo, in a recent report, states that the Chefoo Electric Lighting Co., after a long delay, has finally begun to supply electric current to users in Chefoo. The company was formed on January 16th, 1913, with a capital of £10,000, subscribed principally by Chinese. It was duly registered with the Board of Works at Pekin on May 27th, 1913, and received its charter on that day. The plant, as it is now established, represents an outlay of about £5,000, and includes the following machinery:—Two complete sets of 100-KW. alternators, consisting of two alternators three-phase, 50-cycle, 3,300 volts; two Belliss-Morcom vertical compound engines; three Babcock-Wilcox boilers, two Belliss-Morcom jet condensers and pumps, two boiler feed pumps, purifier and heater (combined), and the necessary switchboard. The managers are Chinese, but the chief engineer, his assistants and electricians, are Japanese. The company has spent about £5,000 in material and for erecting poles, &c., throughout the city, and has contracted a loan for £5,000 from the Bank of Industry and Commerce at Chefoo. By the summer of this year the company expects that the number of consumers will necessitate the further purchase of a 200-KW. alternator set. Chefoo is now splendidly lighted. The company estimates that about 1,000 poles will be necessary to fulfil its contract to light the city's streets. The lights on these poles are of 16, 25, 50, 100 and 200 C.P. Outside the harbour there are to be three 1,000-C.P. lights, and the Japanese post office has contracted for one 1,000-C.P. light. Thus far the company reports 1,300 consumers, while a great increase is expected as soon as the company is able to install meters, which it hopes to do shortly. Consumers are classified as (*a*) meter consumers, (*b*) regular consumers on monthly contracts, and (*c*) occasional consumers. The charges are 9d. per KW.-hour with 1s. minimum charge per lamp per hour, and 1s. per meter per month. The charges per lamp monthly contract range from 1s. 3d. for 5 C.P., 2s. 6d. for 16 C.P., 5s. for 50 C.P. to £2 per 1,000 C.P.

NEW ZEALAND.—The American Consul at Auckland reports that very satisfactory progress is being made in connection with the plan of the Dominion Portland Cement Co. to harness Wairua Falls for the production of electrical power and the establishment of a modern cement works at Kekarangi, near Whangerei, New Zealand. To carry out the scheme will entail an expenditure of upwards of £200,000. The plan involves building a canal 1½ miles long, having a width of 23 ft. at the bottom and 66 ft. at the top. This canal will take water from the river immediately above the falls, and conduct it to steel pipes 5 ft. in diameter, which will convey it to the turbines at the power station. The total fall from the reservoir at the end of the canal to the river bed is about 140 ft., and sufficient water will be carried to generate 1,500 H.P. The company is developing two sets of this size, making a total of 3,000 H.P., but the station is being planned for four such units. The cables are of aluminium wire, and the voltage of the current will be 22,000. Arrangements are being made to furnish the city of Whangarei with electric light. Apparently American manufacturers are obtaining a substantial share of the contracts. It is said that one American company will furnish about £40,000 worth of machinery and another £25,000 worth of dynamos, generators, transformers and other appliances. The contract for the dynamos is the largest made in New Zealand thus far, and was secured against strong competition from Europe. A wharf is being built in connection with the plant. Apart from the United States furnishing a large part of the machinery an American engineer is erecting the mill.

CHILE.—The American Consul at Santiago reports that electric lighting is general in the cities of Chile, particularly in Santiago and Valparaiso. In steel and concrete buildings steel conduit is used, and in brick and adobe houses brass conduit or porcelain insulators are used in wiring. Steel conduits cost 9½d. per yard, and brass conduits are sold for 2d. One of the electrical contractors states that about 10 per cent. of the wiring is done with steel conduit, between 60 and 70 per cent. with brass conduit, and the remainder with porcelain insulators. Brass is used because it is cheap and easy to work. Practically all tubing, both brass and steel, has come from Germany. The steel tubing comes with the threads cut.

Most of the electrical business is controlled through European houses. One electrical contractor who buys all his supplies from European houses states that he would not be willing to buy supplies from American catalogues because of the fear that he would not get just what he required, as the conditions are quite different from those in the United States. The tubing or conduit generally use in Chile and recognised and accepted by the two light and power companies of Valparaiso and Santiago is what is known as Bergmann tubing. Any material used in electrical installations has to be accepted by the traction and lighting company. However, an inspector of electrical installations is employed by the Chilean Government, and it is suggested that manufacturers and contractors take up with this inspector the question of the use of their material.

It has been stated that dealing with American houses has proved unsatisfactory in a number of cases, because if not quite enough money is sent for the article the order is not filled, and if too much money is sent some additional article is forwarded to the purchaser which he does not want, or the balance is retained as a credit against future purchases. The criticism of the occasional increase in charge above that quoted is also made against American firms by one of the electrical contractors. They understand that quotations in the United States often vary for the domestic trade, and that it is quite possible for variation to occur between receiving the quotation and placing the order; but inasmuch as the foreign business is sought, they feel that quoted prices should be maintained, at least until there is time for the order to be sent.

The regulations of the light and power company of Santiago require that persons desiring to make installations in houses where power is to be used must agree to submit to the regulations and conditions fixed by the company, and must use material approved by the company. These instructions also demand that 1,000 pesos (about £29 at the present rate of exchange) be deposited by the person desiring to make installations, and that the company have the right to change the installations for his account if they are not properly done from the company's point of view, and shall also have the right to impose fines against him up to 50 pesos (29s. 2d.) each for infractions against the regulations, deducting these fines or charges from the 1,000 pesos deposited. It has occasionally occurred that the company would not connect with house installations made by persons whom they had not authorised, but the company is now forbidden by law to refuse to make connections when the person making them has done the work in conformity with the law. Any fines imposed are to be for the benefit of the city, and are to be made in conformity with the report of the general inspection of electrical installations.

The Association of Fire Insurance Companies has no electrical code of its own. The tramway and light company, the National Government, and the Association of Fire Insurance Companies have inspectors of electrical installations.

It is obvious that the heavy American conduit, weighing 50 per cent. more than the samples sent, is superior, but the question as to the need of the heavy conduit is at least an open one in the minds of the consumers. The matter of first cost is very important in Chile, and it is necessary to quote very close to the ordinary prices before the question of quality becomes of much interest. This might not be true in a country where there were many wooden buildings, but wooden buildings with electric lights are rare throughout Latin America.

Most of the contractors or merchants who handle conduits are more or less familiar with English, but there would be absolutely no chance for error in corresponding in Spanish with anybody in Chile, and it probably would be pleasing to most of the people of the country.

Reyrolles and War Service.—MESSRS. A. REYROLLE AND CO., LTD., of Hebburn-on-Tyne, are concentrating all their energies in producing their standard switchgear and accessories for war service. For the information of firms or companies who are engaged on orders for war materials and may perhaps be extending their factories for the production of such requirements, the firm have in stock completed articles, or parts which can be quickly assembled, for 12,000 and 6,000-volt armoured switchgear, and 3,000 and 500-volt armoured draw-out panels (two types). These are being held in reserve for Government work only, and as they are ready to be put together, quick delivery can be given. The firm are also holding in readiness for similar service ironclad distribution boxes up to 400 amperes per way, ironclad switch fuses, 50 amperes, and wall plugs for portable drills and lighting. Both the switchgear and accessories are made to comply with the Home Office Regulations. From time to time illustrated particulars of these manufactures have appeared in our pages, but firms interested can obtain a set of publications from Messrs. Reyrolle which cover the whole ground.

Metal Markets.—QUIN'S "Metal Market Letters," which have hitherto been circulated privately among large consumers of, and dealers in, metals, and among merchant firms, now appear under the title of the *Metal Bulletin*, published twice weekly, on Tuesday and Friday mornings.

Prices Advance.—THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., of Silvertown, announce that, owing to the increased cost of production, both in materials and labour, consequent upon the war, prices in their List No. 27 (gutta-percha, india-rubber, silk and cotton-covered wires, &c.) were advanced by 10 per cent. from May 6th, with the exception of toolboxes, tools, and jointing materials, the prices of which are withdrawn.

Book Notices.—"Advanced Theory of Electricity and Magnetism." By W. S. Franklin and B. McNutt. London: MacMillan & Co., Ltd. Price 8s. 6d. net.

"How to Cook by Electricity." By Amy Cross and Alys Waterman. London: Lake, Sison & Brown, Ltd. Price 9d.

For Sale.—Sheffield Tramways Department have for disposal a wheel boring and surfacing machine; Wigan Corporation has for disposal a quantity of scrap copper. Particulars are given in our advertisement pages.

Bankruptcy Proceedings.—James Wm. Tattersall and Tom Whitaker Tattersall, lately trading as Tattersall and Tattersall, electrical engineers, at Kimberley Road, Willesden Lane, N.W.—An application for order of discharge was made on Tuesday to Mr. Registrar Linklater at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the debtors failed last February, with provable debts £8,965 and assets that had realised £418; it was anticipated that a further £31 10s. would be received, and that a dividend of about 7d. in the £ would be paid. The debtors commenced business in August, 1912, as motor engineers, at 9, Regent Street, W. Their business, which consisted in the purchase and sale of carburettors, was successful; in August, 1913, they patented a self-starter, in connection with which they registered the trade mark, "T. A. T." In the following November they took works at Kimberley Road for the purpose of making these machines, and at the same time entered into an agreement with "The Imperial Motor Industries, Ltd.," under which that company were appointed their sole agents for the sale of the machines in Great Britain and the Colonies. The agreement further provided that the company should take delivery of 1,000 machines, at the rate of 60 a month, and at a price which would have produced a profit to the bankrupts of £10,000. To enable them to meet the initial expenses of setting up machinery for the manufacture of these machines, the company advanced them £3,600: to enable them to deliver the said machines to the company they entered into subsidiary contracts with different firms for the supply of the necessary parts; owing to delay in delivery of these parts they were unable to supply the company with the machines within the time allotted by the agreement; as a result of negotiations the company expressed their willingness to vary the agreement in their favour, but on the outbreak of hostilities in August last notice to terminate the agreement was given them by the company for breach of contract, and the losses sustained thereby had resulted in their bankruptcy. The only offence reported by the Official Receiver was insufficiency of assets to pay 10s. in the £ to the creditors, and his Honour granted orders of discharge to both debtors subject to a nominal suspension of three weeks, remarking that to a certain extent the war had brought about the bankruptcy.

Dissolutions.—West Lancashire Cinema Co., Golborne.—Messrs. R. Bond (electrical engineer) and C. Whelan (painter and decorator), have dissolved partnership. Mr. C. Whelan will continue the business under the same style.

Coleraine Manufacturing Co., electrical engineers and manufacturers, 63, Turnpike Lane, Hornsey, N.—Messrs. F. C. Grund, W. H. A. Butterfield, A. E. Frost, and T. B. Batchelor have dissolved partnership, only as far as concerns Mr. T. B. Batchelor. Debts will be attended to by the remaining partners.

Private Arrangement.—Allen & Grosse, Ltd., Queen Street, Belfast, electrical engineers.—An adjourned meeting of the creditors interested herein was held last week, when it was decided that the liquidation was to be continued with Mr. Kennedy as liquidator. The committee which looked into the value of the assets recommends the sale by the liquidator of the assets to Mr. Allen, one of the directors of the company, at, it is thought, such a price as will give the creditors a composition of 6s. 8d. in the £, or the greater part thereof.

Deed of Assignment.—A. Hartley & R. W. Leek, electrical engineers, Colne.—Particulars of claims for dividend must be sent by May 29th to the trustee, Mr. R. A. Hargreaves, 2, Albert Road, Colne.

Catalogues and Lists.—Trafford Park Estates, Ltd., Trafford Park, Manchester.—We have received a 60-page illustrated pamphlet giving very full information respecting Trafford Park and its excellent facilities as a manufacturing district. The important electrical and engineering works situated there have made the estates to our readers one of the most familiar industrial centres in the kingdom. Developments are constantly proceeding there, and a coloured map which accompanies the pamphlet shows the location of existing factories and indicates what land is still for sale or lease.

Armorduct Manufacturing Co, Ltd, Farringdon Avenue, London, E.C.—Four-page illustrated and priced leaflet relating to "Little Hustler" electric drills.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—8-page illustrated leaflet particularising and stating reduced prices of Ediswan ironclad switches and switch fuses.

Messrs. Alexander Duckham & Co., Ltd., Phœnix Wharf, Millwall, London, E.—Booklet giving information regarding their antiseptic "Immutol" cutting compound, and a list of users.

Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—Folder illustrating their "El Grillstovo," an electric cooking set consisting of a circular heater, pan, and grill deflector, which they are pushing as a new summer selling line.

Messrs. Steel Tubes and Conduits Co., Alice Street, Keighley.—Priced leaflet relating to "Spring" inspection fittings.

Trade Announcements.—The Peninsular Engineering Co., Ltd., Suffolk House, Laurence Pountney Hill, London, E.C., inform us that they have been appointed sole agents for the firm of Luis Berenguer, en Cta. Barcelona, makers of high and low-tension porcelains for the electrical trade.

The Hoffmann Manufacturing Co., Ltd., of Chelmsford, have opened offices at Victoria Buildings, 31, Grainger Street, Newcastle-on-Tyne, which are under the control of Mr. T. P. Brady. Telephone: No. 3736 Central; telegrams: Hoffmann, Newcastle-on-Tyne.

LIGHTING and POWER NOTES.

Barford.—The Warwickshire C.C. has given permission for the Barford Electric Supply Co., Ltd., to use overhead transmission between the village and Forge Cottage on the main road.

Barrow.—The Corporation Electricity Committee is making considerable extensions to meet the establishment of works engaged on Government orders. The L.G.B. has sanctioned the borrowing of £500 for the provision of switchgear and connections for the new turbo-alternator at the works, whilst mains are to be laid to a former candle works at an estimated cost of £1,150, and switchgear and a transformer.

Birmingham.—Temporary Power Station.—Last week members of the Electricity Committee paid a visit to the temporary power station being erected at Nechells, at a cost of £97,000. The contracts for this plant were let at the end of last year, and it is expected that the station will be in use by the end of August. It will contain two 5,000-kw. turbine sets, with condensers, and six boilers, each of 33,000 lb. evaporation; five wooden cooling towers are being erected to deal with the circulating water. The installation is to be housed in a steel-frame building. At the present time the pile foundations of the permanent station are being put in.—*Birmingham Daily Post.*

Blackrock (Co. Dublin).—Loan Refused.—The Treasury has refused the Council's application for a loan of £15,000 for an electric lighting installation in the township.

Bradford.—Mains Extensions, &c.—The Electricity Committee proposes to extend the mains at a cost of over £7,000. The Committee's agreement with Messrs. Mitchell Bros. in regard to the bulk supply of current, is to be extended for a further period of 3½ years. Until further order the maximum price to consumers who are charged for electricity under the maximum demand rate, is not to exceed 4d. per unit. The Committee has decided to remit as from April 1st, the rental charges for such hired arc lamps as cannot be used by reason of the lighting restriction order, until such restrictions are removed. The amounts paid in advance as rental for the three months ending June 30th will be kept in hand and made to apply for the three months immediately succeeding the revocation of the order. If a customer desires to terminate the hiring agreement, the Committee proposes to enforce the usual six months' notice.

Brighouse.—Rate Relief.—A sum of £300 is being allocated from the electricity undertaking towards the relief of the rates.

Bristol.—New Plant.—The Electricity Committee recommends the provision of a 6,000-kw. turbo-alternator with the usual accessories, at a cost of about £26,949.

Burnley.—Borrowing Powers, &c.—The Corporation is authorised to spend £23,370 for H.T. alternating plant, and £5,750 for mains; of the former £15,000 has been borrowed, and £17,337 spent, and none of the second amount has been borrowed, but £2,646 has been spent.

In consequence of the L.G.B.'s circular the Electricity Committee has decided that no further sanctions be applied for in respect of any works not already commenced, or expenditure not already incurred, but that the L.G.B. be asked for permission to borrow money in respect of expenditure already incurred, and to which the department was already committed.

Bury.—Year's Working.—On the past year's working of the electricity undertaking there was a net profit of £2,038, being a decrease of £147; £1,038 is to go to reserve fund and £1,000 towards the relief of the rates.

The T.C. has, in consequence of existing circumstances, decided not to proceed with the extensions to the Chamber Hall power station.

Canterbury.—Restricted Lighting.—The charges for street lighting by electricity for the past quarter have been reduced by £249, owing to restricted lighting.

Carnarvon.—The T.C. has decided to take no action in regard to the suggested transfer by the National Electric Construction Co. of the electricity undertaking to a company by Act of Parliament, and the company's suggestion that the L.G.B. should be applied to for a suspension of its and the Council's obligation in the matter of the sinking fund instalments during the period of the war. A loan of £500 for the extension of the cables to the new tuberculosis hospital at Brynseiont has been applied for.

Chile.—The electric light and traction company of Valparaiso has demanded the rescission of its lighting contract with that municipality, owing to the non-payment of an account of a million and a half dollars for public lighting.—*Review of the River Plate.*

Chipstead (Surrey).—Prov. Order—The B. of T. has granted a prov. order for E.L., at Chipstead, which is in the area of the Reigate R.D.C., and also for a portion of the parish of Woodmansterne, in the area of the Epsom R.D.C.

Cuba.—The following persons have been granted permission to install electric power and lighting plant:—Senor Benito Cabrera, at Fomento, Province of Santa Clara; Senor Francisco Frias, at Niquero, Province of Oriente; Senores José F. Prieto and José Lores, at Real Campina, Province of Santa Clara, and also at Cartagena, in the Municipal District of Rodas. The *Gaceta*, which contains particulars regarding the installations to be carried out, may be consulted at the Commercial Intelligence Branch of the B. of T.

Dalkey (Co. Dublin).—E.L. Scheme.—The U.D.C. has under consideration a proposal to obtain from Kingstown a supply of electricity to light the town.

Darwen.—The net profit on the working of the electricity undertaking for the past year amounted to £279.

Dover.—War Bonuses.—The Corporation Electricity Committee has decided to pay the employés a war bonus from May 1st, and to apply to the Government for War Office badges for men of military age engaged at the works, on condition that they agree to join the Army if called upon.

The Council has decided to give notice to three clubs in the town that the existing contract for current for lighting will cease on June 30th, and that meters will be fixed to ascertain future consumption.

Dundee.—Loan Sanction.—The Secretary for Scotland has authorised the borrowing of a further loan of £29,000 in connection with the electricity department.

Enniscorthy.—A provisional order has been granted to the Council for the supply of electricity to the town.

Epsom.—Fuel Contracts, &c.—The U.D.C. has authorised the acting electrical engineer to order for trial 10 tons of Mexican fuel oil for use in the Diesel engines. The cost will be 15s. below the price of American oil, which is £4 per ton, with a tendency to advance.

Gillingham (Kent).—The T.C. has decided to renew, for a further five years, the contract for the supply of current to the Millitary Barracks, &c., subject to the charge for lighting being increased from 2¾d. to 3d. per unit. Owing to inability to obtain a loan for the capital outlay, the Electric Lighting Committee recommended that it could not accede to the request for a supply of current to Messrs. Goldsmith for the Rainham Cement Works. The Council has decided to ascertain whether the firm would pay the interest on the capital expenditure involved.

Ilford.—The U.D.C. has applied to the B. of T. for consent to erect a generating station on a site in Suffolk Road, Seven Kings.

London.—A conference on the subject of London electricity supply is to be held at County Hall on May 19th.—*City Press.*

Islington.—The B.C. has been recommended to increase the scale of pay of junior shift engineers in the electricity department from 30s. to £2 per week. The Lighting Committee has made a reduction of £380 in the charge for street lighting for the March quarter. The borough treasurer has reported on the question of loan sanctions and capital expenditure of the electricity department, and the Finance Committee recommends that application be made for loans of £1,566 for property and £4,975 for mains; the construction of cooling towers, to cost £4,250 is in progress, and it is desired to borrow money to complete this work. As regards a scheme for extension of mains, boilers, &c., not sanctioned, estimated to cost £52,757, application for sanction has been made to the L.C.C., which is obtaining the views of the Treasury on the matter.

Leeds.—Loan Sanctions.—The L.G.B. has sanctioned the borrowing of the following sums in connection with the electricity undertaking, viz., £36,600 for buildings, &c.; £12,290 for suction ash plant, coal-conveying plant and crane; £8,066 for switchgear and foundations; and £3,070 for motors and mains in generating station (these being further instalments of the £200,000 loan), also £22,500 for a new 6,000-KW. plant, £2,500 for building extensions for spare, £65,000 for mains (excess and prospective expenditure) and £12,000 for sub-stations (prospective expenditure).

Leigh.—The T.C. has received a letter from the Director of Navy Contracts pointing out that the Anchor Cable Co. had recently experienced difficulty in obtaining sufficient electric supply for their works, and that in consequence the Government work which the firm have in hand had been seriously delayed; the Town Clerk was instructed to send a copy of the letter to the L.G.B., with a view to expediting the application now before it for sanction to borrow money for further extensions to plant at the electricity works.

Maidenhead.—Restricted Lighting.—The E.L. Committee has offered the Corporation a rebate of 17s. 6d. per annum for each side street lamp extinguished, and 15s. per annum for each 100-watt lamp removed from the main street cluster lamps, or a total reduction of £263 per annum on the whole of the lamps supplied with current.

Nottingham.—Year's Working.—The accounts of the electricity department for the year ended March 31st last show a net profit of £13,402, of which £9,500 is to be contributed in aid of the rates, and the remainder carried to the reserve fund. The number of units sold during the 12 months amounted to 12,860,348, an increase of 229,508 as compared with the previous year. Of this amount 3,805,574 was used for lighting purposes, 3,248,085 for power purposes, and 5,806,689 for traction purposes.

Oulton Broad.—Restricted Lighting.—The U.D.C. has asked the Electricity Co. to allow an abatement of 50 per cent. in the charges on account of the restricted public lighting. The company had offered a 5 per cent. reduction.

Rotherham.—Year's Working.—The gross profit of the electricity undertaking for the year ended March 31st last shows a decrease of £2,201 as compared with the previous 12 months, due to the increased cost of production, which went up from ·651d. to ·700d. per unit. The demand for power is still on the increase and greatly exceeds the combined supply for lighting and traction. On account of the reduced price per unit to the tramways department during the year, there has been a saving to that department of £1,185, which represents nearly one-half of the fall of profits in the sale of electricity for 1915 as against 1914. The total units have increased from 4,797,221 to 5,547,149, and the total receipts from £25,944 to £26,889, or by 3½ per cent. The department has been further affected by increases in interest and sinking fund brought about through recent extension to the works. The net profit available for appropriation has decreased from £7,358 to £4,786.

Runcorn.—The B. of G. has decided to close down the electric light plant for the time being and use oil lamps. Some little time ago it was decided that the plant be overhauled, but this work is now deferred.

St. Anne's.—Year's Working.—For the year ended March 31st last, the Corporation E.L. department sold 1,944,703 units, as compared with 1,051,815 in the previous year. The number of consumers is now 1,632, an increase on the year of 182. The increase in the consumption for power purposes has, according to the electrical engineer, been stimulated by the reduced uniform price of 1d. per unit.

Saxilby (Lincs.).—E.L. Scheme.—Mr. C. H. Best, who is acting with Mr. Chas. Pullan, of Bradford, has approached the Welton R.D.C. respecting a scheme of E.L. for the parish of Saxilby, and has applied for the Council's formal consent to the scheme.

Sheffield.—Loan Sanctions, &c.—Mains are to be extended at a cost of about £12,620. Of this sum over £11,000 will be spent on an additional extra H.T. feeder from Neepsend power station to Tinsley. The L.G.B. has sanctioned the borrowing of £134,373 for the purposes of the electricity undertaking, made up as follows:—£20,000 for sub-station buildings and equipment, transformers and power factor rectifiers (being part of application for £50,000); £86,813 for additional plant at Neepsend; and £27,560 for extension of buildings at Neepsend, and the purchase of 50-ton crane. Land is to be purchased in Forncett Street for use as a sub-station.

Southport.—The Electricity Committee has decided to inform the Finance Committee that it cannot see its way to contribute to the relief of the rates this year.

Occupiers who have given notice of intention to remove lamps outside their business premises, are to be asked to allow the lamps to remain on the understanding that no charge will be made for the hire of them.

The T.C. is to be recommended to approve a proposal to increase the price of electricity by 10 per cent.

Stanley.—Prov. Order.—The B. of T. has notified the Wakefield Corporation of its intention to issue a prov. order authorising the Electrical Distribution of Yorkshire to supply electricity in the district.

Sutton.—We understand that the South Metropolitan Co.'s electricity works at Sutton are to be shut down, and that it is proposed to lay duplicate mains from Wandsworth to the present station, where the current will be transformed to the existing pressure and distributed.

Torquay.—In view of the restriction put upon loans, the T.C. has decided to discontinue for the present the laying of new mains in streets where the supply is not already available. The L.G.B. has intimated that there is no necessity for the purchase of premises in Victoria Parade for new offices for the electricity department. The Council, however, has decided to adhere to the principal of acquiring the premises, and to proceed with the purchase on its own responsibility. The Council has offered a supply for E.L. to the Torbay Hospital at 3½d. per unit.

Walsall.—Loan Sanction, &c.—With respect of the Council's application for sanction to a loan of £23,595 for the purposes of the undertaking, the L.G.B. has authorised the borrowing of sums amounting to £16,700.

A coal clause is to be inserted in all future agreements for a supply of alternating current in bulk. The lighting of the new road from Ablewell Street to Birmingham Road is to be carried out by lanterns suspended from the tramway span wires on both sides of the road.

Warrington.—A new turbo-alternator was formally started at the electricity works, at Howley, on May 6th.

Watford.—The T.C. has decided to defer all large extensions of the undertaking, and to make application for sanction for the money which has already been spent. The cost of any future house connections, &c., will be paid for out of revenue.

West Bromwich.—The T.C. has entered into an agreement to supply electricity up to a minimum of 80,000 units per annum for three years to the Mechanical Brake Co., and to give a supply for war purposes to Messrs. Ebenezer Parkes & Co., Atlas Works.

Wigan.—PROPOSED LOANS.—Application is to be made to the L.G.B. for sanction to borrow £1,200 for a transformer, switchgear and cable required for the proposed supply of electricity to Pemberton Colliery Co., and £1,066 for a transformer, &c., to supply current to the Empress Spinning Co.

Wimbledon.—STREET LIGHTING.—The E.L. Committee recommends a reduction in the charge for lighting the streets; in future one equal eighth part of the amount of instalments of loan, sinking fund and interest as shown in the net revenue account of the electric lighting accounts for the previous year, will be charged against street lighting, instead of one equal sixth part of the amount referred to as heretofore.

Wistaston.—E.L. SCHEME.—The Crewe Corporation has received the Nantwich R.D.C.'s consent to its application to the B. of T. for an order authorising the supply of electricity to premises in Wistaston.

Wolverhampton.—The Electricity Committee proposes to lay a new feeder cable from the School Street sub-station to Lea Road, at a cost of £1,130, and to carry out mains extensions at a cost of £730. Of this amount £133 will be provided out of the reserve fund, and the remainder out of the capital account, for which latter the sanction of the L.G.B. will be required.

TRAMWAY and RAILWAY NOTES.

Accrington.—YEAR'S WORKING.—The gross revenue of the Corporation tramways for the past year amounted to £27,850, and the gross expenditure to £16,438; after deducting £8,233 for interest on loans, dividends on stock, redemption of debt and income-tax, there was left a disposable balance of £3,179, as compared with £4,722 in the previous year. The contribution to rate aid was £2,013, a motor tower-wagon cost £598, and £568 was devoted to depreciation and renewals. During the year 4,637,303 passengers were carried, and 548,070 car-miles run.

Bradford.—The Tramways Committee has authorised the general manager to arrange such modifications in car services after 9 p.m. as may be deemed fit on consideration of traffic returns, and recommends that the North Park Road car service be discontinued, in view of the continued low receipts shown by traffic returns. The Tramways Committee has approved a scheme for a central terminus at Forster Square.

Bury.—YEAR'S WORKING.—The net profit on the working of the Corporation tramways for the past year was £9,690, which will allow £5,600 to be paid to the rates, and £3,472 to be placed to the reserve fund.

Darwen.—YEAR'S WORKING.—The tramway department made a net loss of £172 on the Darwen section and £557 on the Hoddlesden section during the past year. The mileage run was 267,670, against 266,912 in the previous year, and nearly 250,000 fewer passengers were carried.

Glasgow.—FEMALE LABOUR.—This week an additional 50 women have begun their training as conductors, and next week over 100 women will be engaged in this duty in connection with the T.C.'s tramway department.

The tramway department's financial year ends on May 31st, and on Monday of this week the million pounds sterling of revenue, which is now looked for, was secured. Up till Sunday night the total drawings amounted to £999,494, and Monday's takings brought the gross to £1,002,624. The total at corresponding date last year was £1,010,792, this year's revenue so far working out at £8,168 less.

London.—The Standing Order Committees of both Houses of Parliament have been petitioned for special leave to deposit a Bill to authorise the City and South London Railway, the Central London Railway, the London Electric Railway, the Metropolitan District Railway and the London General Omnibus Co. to enter into agreements "for the purpose of providing increased facilities for the interchange and alternative routeing of traffic, the application of receipts and the appointment of a Joint Committee."

L.C.C.—The Highways Committee is considering the desirability of the Council again bringing before the Treasury the great public need of electrifying the tramways in Grange Road, Southwark Park Road, Raymouth Road and Rotherhithe New Road. The service has been discontinued since May 1st, owing to the dangerous state of the rails.

The Treasury has advised the postponement of the Burdett and Grove Road tramway reconstruction, and of the purchase of additional turbine plant for the Greenwich station.

Manchester.—The City Council has rejected a proposal brought forward by Councillor Cundiff, that special constables should be allowed free rides on the cars when going to or returning from duty.

Nottingham.—YEAR'S WORKING.—There was a net profit of £28,664 on the working of the Corporation tramway undertaking for the year ended March 31st last; of this sum £22,500 is to be contributed in aid of the rates. Traffic receipts showed an increase of £4,850 at the end of July, after which there was a general falling off to the end of the financial year, notwithstanding the additional receipts obtained from the three extensions, and a full year's working of the Notts. and Derbyshire Co.'s cars running between Church Street, Basford, and Parliament Street. The total receipts, including rent for the leased lines, but excluding interest on investments, amounted to £179,315, an average of 11·35d. per car-mile. This is an increase of £3 935 in receipts, but a decrease of ·52d. per car-mile, compared with the previous year. The working expenses amounted to £112,583, equal to 7·13d. per car-mile, compared with 7·45d. per car-mile. The consumption of energy for traction, car and depôt lighting, works machinery, permanent way repairs and renewals, and grinding out rail corrugations, was 5,806 688 units, costing £30,243. This is equal to 1·53 units per car-mile, compared with 1·51 units during the previous year. The number of passengers carried was 41,210,964, an increase of 675,000.

Oldham.—There was a loss of nearly £5,000 on the working of the tramways during the past year.

Plymouth.—TRAMWAYS PURCHASE SCHEME.—At a meeting of the T.C. it was reported that the Devonport and District Tramway Co. was willing to selling its undertaking to the Corporation on Tramway Act terms at once, instead of in 1919, the Corporation to have immediate possession, and the price to be fixed by arbitration. These terms were approved, and it was resolved to enter into an agreement with the company. It was further reported that the Plymouth, Stonehouse and Devonport Tramway Co. was willing to hand over its undertaking to the Corporation at once, instead of in 1922, on terms to be agreed. It was resolved that an agreement be entered into accordingly, and in the event of a difference as to price, that the same be settled by arbitration.

Reading.—The net profit on the tramway undertaking for the year ended March 31st last amounted to £4,647, £3,000 of which is to go to the relief of the rates. The T.C. has decided to lay new feeder cables at a cost of £450.

Rotherham.—YEAR'S WORKING.—During the past year the Corporation cars ran 815,547 miles, as against 852,869, in the previous year; the passengers carried decreased from 9,874,231 to 9,828,838. The gross profit of £14,901 was an increase on the previous year of £900, which, after deducting the usual allowance for redemption of debt and contribution to sinking fund and interest, leaves a net profit of £5,582, or an increase of £546 as compared with the preceding 12 months.

Salford.—FEMALE LABOUR.—The Tramways Committee considered the question of the men's refusal to work with women tram conductors and the demand of the men for a bonus of 15 per cent. on wages, and ultimately decided to adhere to the decision to employ women conductors. In the matter of war bonuses, Salford had followed the lead of Manchester in giving a bonus of 2s. a week to employés earning 28s. a week or less and a smaller bonus to those earning between 28s. and 30s., and it was decided not to vary this to meet the men's request. At the T.C. meeting last week, the principle of employing women was approved, and the question of the conditions of such employment referred back for further consideration.

South Shields.—At a meeting of the T.C., on the 5th inst., Alderman Lawson, in moving the adoption of a report of the Sub-Committee on the Parliamentary Bill, said there had been left in the Bill the tramway clauses giving power to extend the tramways to the borough boundary and down Mile End Road, which was a rather important and valuable power; they had also got the electrical clauses, which turned out to be more important than they anticipated.

Wigan.—A profit of £900 was made by the tramway undertaking last year.

TELEGRAPH and TELEPHONE NOTES.

Retransmission of Cables.—The following official announcement was issued on Tuesday last :—

It has come to the notice of the Home Office that persons and business houses in this country are receiving requests to retransmit cables between traders in neutral countries, and that in some cases these requests are made with a view to avoiding interference by the Censor by letting it appear that the sender is a well-known British firm. In this way the transmission of messages connected with trade with the enemy may be secured. All persons in this country are therefore warned not to undertake to retransmit cables unless the request comes from a client for whom they have been accustomed to perform this service, and unless they are satisfied that, by forwarding the message, they are not assisting trade with the enemy.

United States.—An action is in progress between the American Marconi Co. and the Atlantic Communication Co., which operates the Telefunken system at Sayville, the former alleging infringement of its patents. Mr. Marconi has attended the trial to give evidence on behalf of the plaintiffs.

According to the report of the Census Bureau for 1912, the mileage of telephone wire in use was over 20 million miles; companies controlling 94 per cent. of the mileage reported 13,735 million calls, and that the capital of the above-mentioned companies was 991 million dollars. The net income was 51 million dollars, and the number of employés 183,000. The Bell system controlled 75 per cent. of the mileage and 58 per cent. of the telephones in use; the total number of telephones connected with public exchanges was 8,730,000. The number of independent rural telephone systems was 32,233. The number of telephones per thousand of the population rose from 30 in 1902 to 72 in 1907 and 91 in 1912; the messages per capita increased from 65 in 1902 to 122 in 1907 and 144 in 1912.

The mileage of commercial telegraph wire, including ocean cable, was 1,882,000, the messages numbered 109,663,000, and the capital employed was $232,000,000. The net income was $6,400,000, a reduction of one-third as compared with 1907, whereas the net income of the telephone companies increased 25 per cent. in that period. There were 38,000 telegraph employés. Six U.S. ocean cable companies owned 44,860 miles of cable, handling 2,845,000 messages, an increase of 20 per cent. over 1907. In addition, the Western Union Telegraph Co. operated 23,800 miles of cable and handled nearly 3,000,000 cable messages.

There were four wireless telegraph companies with 74 tower stations (117 in 1907), and a capital of $9,600,000 ($32,700,000 in 1907). The number of messages transmitted was 285,091, and the net income was $4,738 (deficit of $53,538 in 1907). The employés numbered 958.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Melbourne.—May 18th. Four 250-K.V.A. three-phase transformers; 9,680 yards '05 sq. in., three-core, lead-covered cable, for the City Council. See "Official Notices" April 30th.

May 19th. Victorian Railways. Meters, coasting recorders or other energy-checking devices, for train operation on the multiple-unit system, D.C., 1,500 volts. See "Official Notices" April 30th.

June 15th. City Council. Four mechanically-fired boilers, one turbine-driven boiler-feed pump, two fuel economisers, circulating water pumps. City Electrical Engineer. Specifications from Messrs. McIlwraith, McEacharn & Co., Ltd., London, E.C.

June 30th. Victorian Railway Commissioners. One 13-in. centre lathe for turning or grinding commutators for traction armatures; one 9-KW. motor-generator and battery-charging accessories; four electric motors.*

Sydney.—June 16th. Deputy P.M.G. 400 Morse sounders, American pony pattern. (Schedule No. 449.)*

July 19th. Municipal Council. One or two 12,000-KW. turbo-alternators (Contract No. 363).* A copy of the specification can be obtained from the City Electrical Engineer, Sydney.

July 19th. Steel towers for 33,000-volt transmission line. Specification (10s. 6d.) at E.L. Department, Town Hall.

July 21st. N.S.W. Government Railways and Tramways Department. One 250-K.V.A. turbo-generator.*

Toowoomba.—June 7th. 480-volt D.C. electrically-driven centrifugal well-sinking pump, 30,000 gallons per hour, against a head of 200 ft. max. Deposit 2½ per cent. City Engineer.

Specifications for the items marked * can be seen at the B. of T. Commercial Intelligence Branch in London.

China.—Shanghai.—May 20th. 2,600 yards of three-core E.H.T. armoured cable, and 79 three-phase induction motors, for the Municipal Council. See "Official Notices" May 7th.

Darlington.—May 20th. Corporation. Cast-iron condenser water pipes. See "Official Notices" May 7th.

Dover.—May 18th. Six electric vehicles, for the T.C. See "Official Notices" May 7th.

Dublin.—May 25th. Corporation. Underfed stoker. See "Official Notices" to-day.

May 20th. Corporation. Supply of coal for the Electricity Department, &c., for one, two or three years, a 12 months' supply being approximately 40,000 tons. Copies of specification from the Town Clerk.

Finchley.—May 31st. U.D.C. Wiring, for light, 100 workmen's dwellings. See "Official Notices" May 7th.

France.—The Administration des Chemins de fer de l'Etat, 43, Rue de Rome, Paris, will receive offers on Tuesdays and Fridays, from 3 to 5 p.m., for the following supplies:—Up to May 21st: six electric cranes (two of 60 tons, two of 40 tons, one of 25 and one of 20 tons); up to May 28th: six converter sets, a switchboard, and low-pressure mains.

Leeds.—May 26th. Corporation. Steam, feed and water pipes. See "Official Notices" May 7th.

Leigh (Lancs.).—May 21st. One vertical tube boiler, one 250 KW. rotary converter or motor converter, one switch panel, for the Borough Electricity Committee. See "Official Notices" April 30th.

Manchester.—June 2nd. Corporation. Coal-unloading crane, conveying plants, &c. See "Official Notices" May 7th.

May 18th. Tenders are invited for additions to accumulator house and laundry at Baguley Sanatorium. Particulars from the City Architect (one guinea, returnable).

May 19th. The Guardians invite tenders for the conversion of the hydraulic lift at their infirmary into an electric lift. Specifications, &c. (10s., returnable), from Mr. A. J. Murgatroyd, 23, Strutt Street, Manchester.

Portsmouth.—June 1st. Corporation. 100 tons of steel girder tram rails, five tons of steel fishplates, one ton of fish-plates, three tons of 5-ft. wrought-iron tie-bars. See "Official Notices" to-day.

May 26th. Electric lighting, &c., at Girls' Hostel, for the Education Committee. See "Official Notices" to-day.

Rochdale.—May 17th. Steam coal, for the electric power station, Dane Street. Mr. C. C. Atchison, Engineer and Manager.

Sheffield.—May 28th. Two natural draught cooling towers complete. For the Electric Supply Department. See "Official Notices" May 7th.

Spain.—The municipal authorities of Camporroble (Province of Valencia) have just invited tenders for the concession for the electric lighting of the town during a period of two years.

Tasmania.—Launceston.—July 26th. Sub-station equipment. Section I, Converter machine, switchgear, &c.; Section II, Underground feeder cable. Specification (21s.) from the City Electrical Engineer, Town Hall.

Wigan.—May 29th. Corporation. H.T., three-core, paper and lead-covered, armoured feeder cable, transformer and switchgear. See "Official Notices" to-day.

CLOSED.

Aldershot.—The Electricity Committee recommends the acceptance of the following tenders for new plant:—C. A. Parsons, £3,858; Babcock & Wilcox, £1,115.

Bradford.—The Cleansing and Team Labour Committee has accepted the offer of the New Destructor Co., Ltd., to construct six cells and a combustion chamber, with multitubular boiler and all machinery and accessories (in lieu of existing 12 cells) for £2,977.

The Electricity Committee recommends the acceptance of the tender of the Brush Electrical Engineering Co., Ltd., for a 600-K.V.A. three-phase transformer, for the proposed electric supply to Dumb Mill, at £222; and the Tramways Committee that of Messrs. Hadfield's, Ltd. (£572), and Messrs. Edgar Allen & Co., Ltd. (£414), for points and crossings.

Burnley.—For the ensuing year the T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for motors, and that of Messrs. Ferranti, Ltd., for starters.

Dundee.—The Corporation Electricity Committee recommends acceptance of the following tenders in connection with the new pumping station at Carolina Port:—

Pumping plant.—W. H. Allen, Sons & Co., Ltd.
Pipe line.—John Wilson, Ltd.
Reinforced concrete pumping room.—Yorkshire Hennebique Co., Ltd.

Holmfirth.—The U.D.C. has accepted the tender of Mr. Robert Turner, for the erection of the electricity generating station.

Hong-Kong.—The Hong-Kong Electric Co., Ltd., have placed contracts as follows for their new power station:—

Steel structural work, &c.—United States Steel Products Co.
Boiler plant.—Babcock & Wilcox, Ltd.
Coal-handling plant.—Babcock & Wilcox, Ltd.
Turbo-alternators and switchboard.—Brit. Thomson-Houston Co., Ltd.

Glasgow. — The Tramways Committee recommends acceptances of the following tenders for six months :—

Steel axles, tires and wheels.—John Baker & Co., Ltd.; Glasgow Railway Engineering Co., Ltd.; Brown Bayley's Steel Works, Ltd.

For 12 months :—

Chilled-iron brake blocks.—Miller & Co., Ltd.
Fire clay goods.—Glenboig Union Fire-clay Co., Ltd.
Springs.—L. Sterne & Co., Ltd.; G. Turton, Platts & Co., Ltd.

The Electricity Committee recommends that the following offers for 12 months' supply be accepted :—

C.I. boxes, section pillars, &c.—Carron Co.; W. Lucy & Co.; Falkirk Iron Co., Ltd.; M'Dowall, Stevens & Co.; Jas. Allan, son, & Sons.
Fire-clay bricks and fire-clay.—Cursale & Co., Ltd; John G. Stein & Co., Ltd.
Single cables, concentric and triple-concentric cables.—Calender's Cable Co., Ltd.
Extra H.T. cables.—W. T. Glover & Co., Ltd.
Rubber-covered cables.—Craigpark Electric Cable Co., Ltd.
Flexibles.—Wm. Rickard, Ltd.
Arc lamp carbons.—C. W. Webster.
Electricity meters.—British Thomson-Houston Co., Ltd.; Ferranti, Ltd.; Chamberlain & Hookham, Ltd.

For six months :—

Wooden troughing cover.—Robinson, Dunn & Co., Ltd.

The Sewage Committee recommends that the offer (£4,325) of the Ames Crosta Sanitary Engineering Co., Ltd., for the supply and erection of distributors in connection with the alterations at Dalmarnock sewage works be accepted, the company having agreed to equip the machines with electric motors in the event of failure of the water-wheel drive.

Leith.—The Corporation has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for carbon-filament lamps for 12 months for the tramways.

London (L.C.C.).—The Highways Committee has received the following tenders for cables in connection with the extension of the Woolwich tramways sub-station and a temporary supply of power for working the Council's tramways—

Western Electric Co., Ltd.	(accepted) £22,971
Callender's Cable and Const. Co., Ltd.	24,651
Johnson & Phillips, Ltd.	28,928
W. T. Glover & Co., Ltd.	24,102
W. T. Henley's Teleg. Works Co., Ltd.	24,990
Siemens Bros. & Co., Ltd.	24,934
B.I. & Helsby Cables, Ltd.	26,036

Estimate of chief officer of tramways £21,262. This estimate was prepared in March, but since that date the price of copper has materially advanced.

SOUTHWARK.—The following tenders for annual supplies have been recommended for acceptance by the B.C. :—

Cable.—Siemens Bros. & Co., Ltd.
Meters.—Reason Manufacturing Co., Ltd, five items; Electrical Apparatus Co., Ltd., five items; General Electric Co., Ltd., 12 items; Chamberlain & Hookham, Ltd., three items; Landis & Gyr, Ltd., three items.

Eleven tenders were received for the cable and the same number for the meters. The tender of the B.I. and Helsby Cables, Ltd., is also recommended for a feeder pillar for £50.

In view of the prevailing conditions, and the satisfactory manner in which the contract has been carried out, the E.L. Committee has agreed to a request from Messrs. Hinchcliffe & Co., contractors for coal, to be paid an extra charge of 1s. per ton for wagon hire. This additional charge is on account of coal purchased in the open market, outside contract prices.

PADDINGTON.—The Guardians have been recommended to accept the tender of Messrs. S. Hammond & Co. to reinstate the telephone instruments, wires, &c., and keep the instruments under repair for a period of 12 months, for £36.

BATTERSEA.—The B.C. Electricity Committee recommends the acceptance of the tenders of Messrs. Ferranti, Ltd., and Messrs. Chamberlain & Hookham, Ltd., for the supply of meters during a period of 12 months.

Maidenhead.—The T.C. has accepted the tender of the Anglo-Mexican Petroleum Products Co., Ltd., for a year's supply of fuel oil for the Diesel engines at the electricity works, at £3 3s. 6d. per ton, the contract to be determined at the end of three months if the oil does not prove satisfactory.

Meter Contracts.—Messrs. Chamberlain & Hookham, Ltd., have received contracts for meters from Colwyn Bay and Edinburgh. Messrs. Venner Time Switches, Ltd., have received a further repeat order from Cardiff for 99 time switches.

The Electrical Apparatus Co., Ltd., has received the following contracts :—

Bury St. Edmunds.—Corporation.—Sole supply of 3 and 5-ampere meters; 12 months.
Leyton.—U.D.C.—D.C. meters; 12 months.
Woking.—The Electric Supply Co.—60 single-phase meters per annum during the next two years.

Newport (Mon.).—The Corporation Electricity and Tramways Committee has accepted the tenders of Messrs. James and Emmanuel, and Messrs. Partridge, Jones & Co., each for 1,000 tons of coal, at 19s. per ton, subject to the electrical engineer endeavouring to obtain an option in favour of the Council to limit the order in each case to 750 tons.

North Ormesby.—Messrs. Clough, Smith & Co., Ltd., of London, have secured from the Grangetown, North Ormesby and South Bank Railless Traction Co. the contract for the construction of their overhead equipment and feeder system (a route length of 5 miles 61 yards).

Rochdale.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for Wotan traction and standard lamps for the Corporation tramways, for the ensuing 12 months, has been accepted.

Salford.—The Electricity Committee has accepted an offer by Messrs. Andrew Knowles & Sons, Ltd., Pendlebury, to supply and deliver about 250 tons per week additional of Clifton Hall washed slack during a period of two months ending July 31st, at 15s. 4d. per ton.

Stretford.—The D.C. has accepted the tender of the General Electric Co., Ltd., for cable amounting to £670. The four 100-KW. sets at the generating station are to be disposed of by the Council at a price approximating to £325 each.

Stockport.—The T.C. on May 5th accepted the following tenders for the electricity works :—

Herbert Morris, Ltd.—40-ton crane £756, and gantry £119.
Stewarts & Lloyds, Ltd.—Steam piping for new turbine and boilers £105 10s., less 2½ per cent.

Tonbridge.—The U.D.C. has accepted an offer by the Medway Coal Co. to supply before June 30th 200 tons of coal for the electricity works, at £1 2s. 9d. per ton, an advance of 3s. per ton on present prices.

Tunbridge Wells.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for supplying new steel sections and drums, with superheaters, to two boilers at the electricity works, at £1,289, with £50 for contingencies. The Council has also accepted the tender of Messrs. Witting & Partners for dismantling the existing cooling tower and building a new tower on the same site, at £1,085.

West Ham.—A T.C. Committee recommends the acceptance of the tender of the British Thomson-Houston Co. for the supply of 160 motors required in connection with the alterations to the equipment of the tramcars, together with the necessary gears, for £106 10s. each.

Winchester.—The T.C. has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., for a 500 KW. turbo-generating set, with condensing plant and piping, at £3,991.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 14th. At 8 p.m. At Institution of Civil Engineers, Great George Street, Westminster. Paper on "The Distribution of Heat in the Cylinder of a Gas Engine," by Prof. A. H. Gibson and Mr. W. J. Walker.

Physical Society of London.—Friday, May 14th. At 8 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "Precision Resistance Measurements with Simple Apparatus," by Mr. E. H. Rayner; "Some Novel Laboratory Experiments," by Mr. F. W. Jordan, "On Electrically-Maintained Vibrations," by Mr. S. Butterworth.

Royal Institution of Great Britain.—Saturday, May 15th, and Tuesday, May 18th. At 3 p.m. At Albemarle Street, W. Lectures (I) and (II) on "Advances in the Study of Radio-Active Bodies," by Prof. F. Soddy.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, May 17th. At 7.30 p.m. At Mining Institute. Annual General Meeting.

Sheffield Electrical Social Union.—Monday, May 17th. At 6.30 p.m. At Stevenson's Restaurant, Castle Street. Tea and social. All electrical business men welcomed.

Foreign Trade. — THE APRIL FIGURES. — The following are the electrical and machinery figures given in the official returns for April :—

	Month of April.		*Inc. or dec.*	*Four months, 1915.*		*Inc. or dec.*
IMPORTS.	£		£	£		£
Electrical goods and apparatus, excluding machinery and uninsulated wire	90,143	−	33,515	283,712	−	269,675
Machinery ...	877,806	+	128,159	2,651,831	−	66,031
EXPORTS.						
Electrical goods and apparatus, excluding machinery and uninsulated wire	238,899	−	43,713	959,632	−	86,489
Machinery ...	1,574,455	−	1,419,884	6,114,239	−	6,870,048

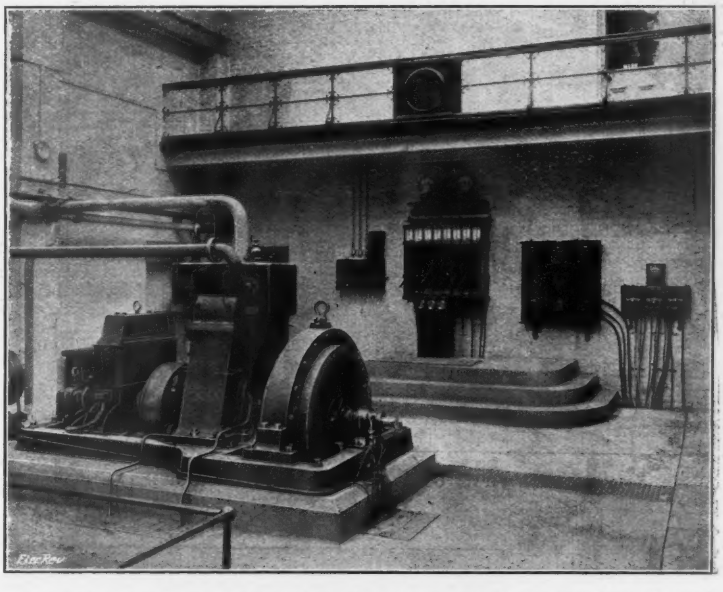
ELECTRICITY WORKS EXTENSIONS AT SOUTH SHIELDS.

During the last two or three years considerable extensions have been made to the plant installed at the South Shields Corporation Electricity Works, by the provision of turbine and rotary converter plant, also a new boiler house with water-tube boilers, bunkers, coal-handling plant, &c., the cost of the additions being some £39,000.

Through the courtesy of Mr. Harry S. Ellis, the borough electrical engineer, we are able to briefly describe and illustrate this plant, which will no doubt largely supersede the McLaren marine type sets and marine type boilers which have been a feature of this station in the past.

The South Shields undertaking was originally started in 1896, Mr. J. A. Jeckell being the first engineer, and two marine type boilers, two 100-kw. alternators coupled to marine type engines, and a small 15-kw. set, to take the day load, were provided; this plant has been added to until to-day some 5,800 kw. of plant is installed.

As regards the plant installed prior to the introduction of turbines and still available for use, what is known as the old boiler house contains six marine type boilers, three fitted with two furnaces and designed to evaporate 7,000 lb. of water per hour, and the other three fitted with three furnaces and designed to evaporate 11,000 lb. The coal used in these boilers is stored in a large brick walled bunker running the full length of the boiler house and capable of containing about 600 tons. The firing is all carried out by hand, three stokers being necessary on the evening shift when all the boilers are working.



Original Ferranti Switchboard and 15-kw. Set, Installed in 1896 at South Shields.

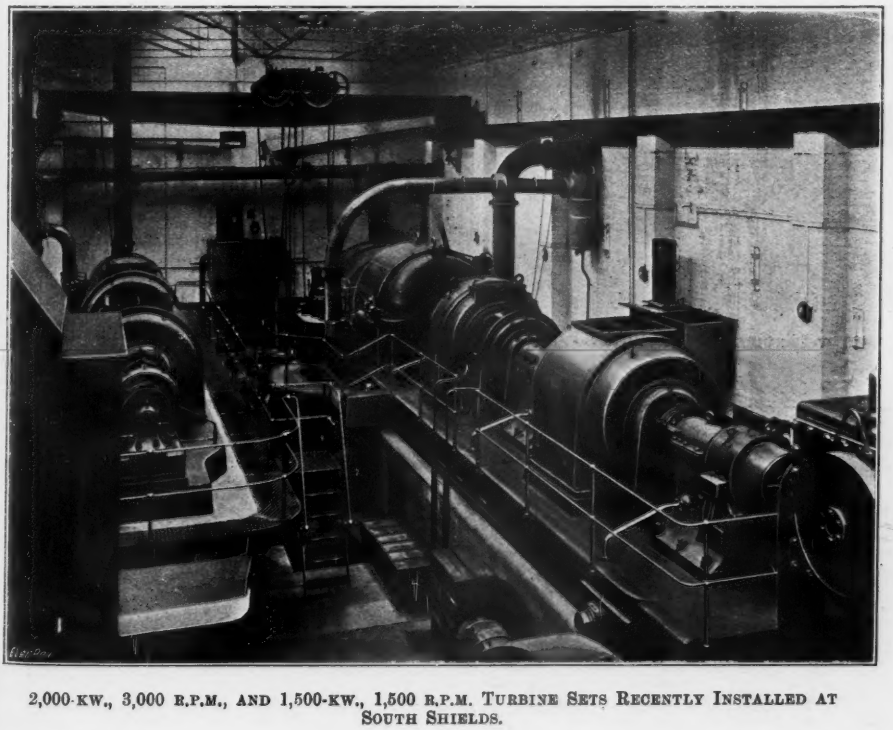
The circulating water for the condensers is lifted from the River Tyne into large storage tanks, capable of containing about 100,000 gallons, by means of five Worthington steam pumps, each capable of delivering 33,000 gallons per hour

There is also a centrifugal pump coupled to a 50-B.H.P. Westinghouse D.C. motor which is capable of delivering 150,000 gallons per hour against a total head of 50 ft.

The engine room consists of two bays, each 100 ft. long, and the smaller one now contains, in addition to the new turbine sets, only one of the old 200-kw. Ferranti single-phase alternator sets coupled to a marine type engine—one 200-kw. and two 100-kw. single-phase sets having been displaced to make room for the new plant.

The Ferranti cellular type single phase switchboard at one end of the bay consists of the original cells with additions.

The larger bay contains two McLaren 1,000-I.H.P. engines driving 500-kw. Siemens and Richardsons, Westgarth single-phase alternators and two similar 1,100-I.H.P. engines driving 550-kw. Dick, Kerr direct-current machines, which were originally installed for supplying the tramways, but are now also used for supplying energy to large power consumers.



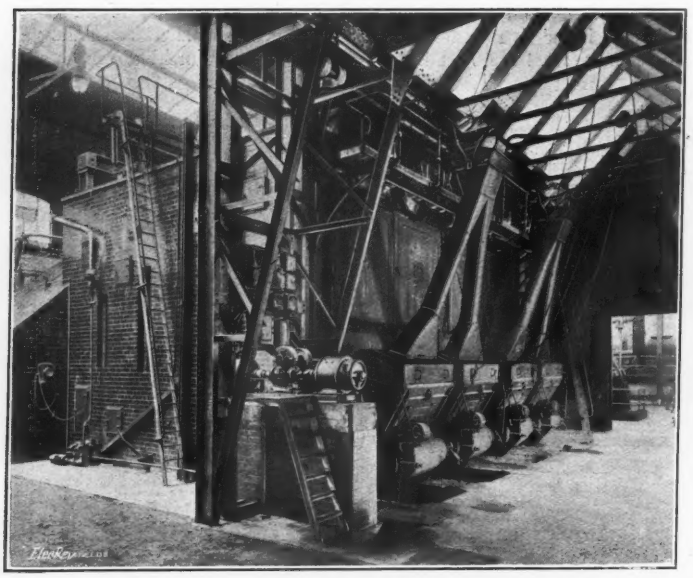
2,000-kw., 3,000 r.p.m., and 1,500-kw., 1,500 r.p.m. Turbine Sets Recently Installed at South Shields.

There are five steam pumps at one end of the boiler house, four for boiler feed and one for lifting the condensate from the hot-well tanks to a Harris-Anderson oil-eliminating plant.

Working in conjunction with the direct-current supply there is a Tudor battery of 500-kw. capacity on a one hour rating, and an automatic reversible booster.

New Generating Plant.—This consists of two Westing-

house-Rateau high-pressure turbines of 1,500 and 2,000 KW. capacity respectively; the former is coupled to a 1,000-KW. 500/550-volt direct-current machine, fitted with a radial



NEW BOILERS, WITH CHAIN GRATES AND DUPLICATE MOTOR-DRIVE.

commutator, and a 1,100-KW. single-phase 2,100-volt 50-cycle turbo-alternator, the two machines being in tandem and running at 1,500 R.P.M.

This set was installed in 1912 under the supervision of Mr. Ellis, but its installation was arranged for by his predecessor, the late Mr. J. H. Cawthra.

The second turbine, put into operation in 1914, drives two 1,500-KW. 2,100-volt three-phase 50-cycle turbo-alternators and an exciter in tandem at 3,000 R.P.M.

The influence of high speed on the size of the later turbine is shown in our view, the higher powered set being much the smaller one.

Both turbines exhaust into Westinghouse-Le Blanc surface condensers, the air and extraction pumps for which are driven by a 30-H.P. D.C. motor. In the case of the three-phase machines, the arrangement of the switchgear allows of one phase being cut out, and the other two, in series, supplying single-phase current. The turbo-generators are cooled by forced air circulation, and, in connection with the latter, a Heenan rotary air filter, capable of dealing with 24,000 cb. ft. of air per minute, has been installed. This apparatus is similar in construction to the same firm's water coolers, but the functions of air and water are reversed, and in this case the air, in addition to being filtered, is lowered in temperature 15° or 20° in hot weather.

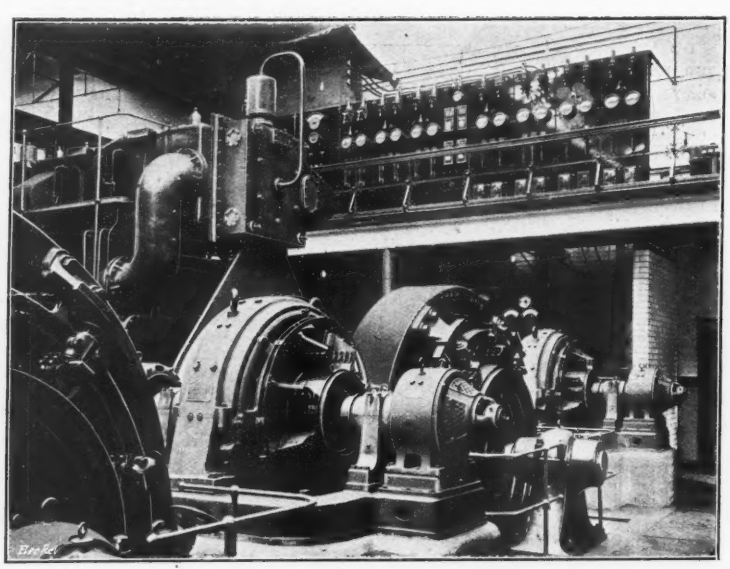
Two 600-KW. Westinghouse rotary converters are installed in the power station to link up the 2,100-volt alternating and 500/550-volt direct-current supplies for traction and power purposes. The transformers, by the same firm, are of the oil insulated self-cooling type; the rotaries are each equipped with a starting motor and exciter, and are arranged for the self-synchronising method of starting.

As regards the new boiler plant and coaling arrangements, coal is unloaded by a wharf crane into a hopper near the centre of the old bunkers; from the hopper it is carried by a belt conveyor, of 30 tons an hour capacity, to the overhead bunkers of the new boiler house, which have a capacity of 560 tons. Space for four boilers is at present available in the new building, which, however, can be increased in width to accommodate another four boilers.

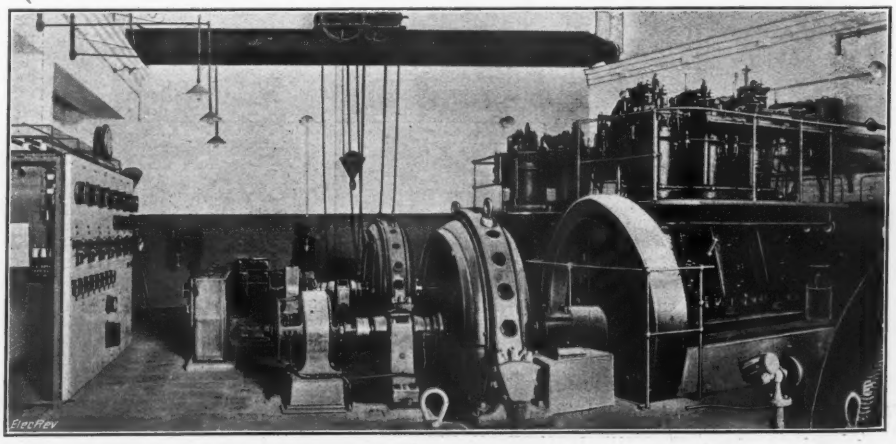
Two Babcock & Wilcox land-type boilers, each of 5,346 sq. ft. heating surface and 22,000 lb. per hour evaporative capacity, are installed and working; these are fitted with integral superheaters and chain-grate stokers.

In connection with this plant there is a Green economiser of 288 tubes, two Weir steam feed pumps, each of 7,500 gallons an hour capacity, and a Lassen & Hjort water-softening plant, capable of dealing with 24,000 gallons a day of town's water, which has an initial hardness of from 25° to 30°, and is used for boiler feed purposes.

The new boilers are operated under induced draught, the flue gases being discharged by Musgrave fans into a new steel chimney,

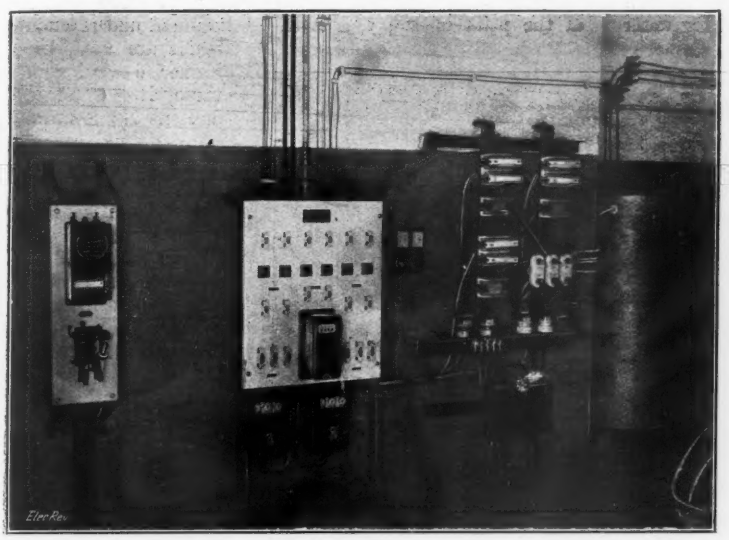


NEW ROTARY CONVERTERS, D.C. PLANT AND SWITCHBOARD, SOUTH SHIELDS.



THREE-PHASE DIESEL ELECTRIC PLANT AND SWITCHBOARD, AHMEDABAD, INDIA (see next page).

of the Thompson self-supporting type, 100 ft. high and 7 ft. 6 in. diameter. These fans, two in number, are flexibly coupled to Westinghouse variable speed 44-H.P.



TRANSFORMER, L.T. AND AUXILIARY SWITCHGEAR.

motors (360-450 R.P.M.), each fan being capable at the lower speed of handling the gases from two boilers, and producing a draught of $1\frac{1}{2}$ in. water gauge. At the higher speed, one fan would deal with the gases from three boilers, giving a $2\frac{1}{4}$ —$2\frac{1}{2}$ in. W.G. draught.

Arrangements have been made to augment the supply of circulating water during the present year by means of two 12-in. Worthington vertical centrifugal pumps, which are to be erected on the jetty, and will deliver to an overhead tank, the total head of the pumps varying between 51 ft. and 34 ft. 6 in., according to the state of the tide.

Each pump will discharge 2,920 gallons a minute, working submerged, and will be driven by a vertical spindle 73-H.P. D.C. motor, running at about 800 R.P.M.

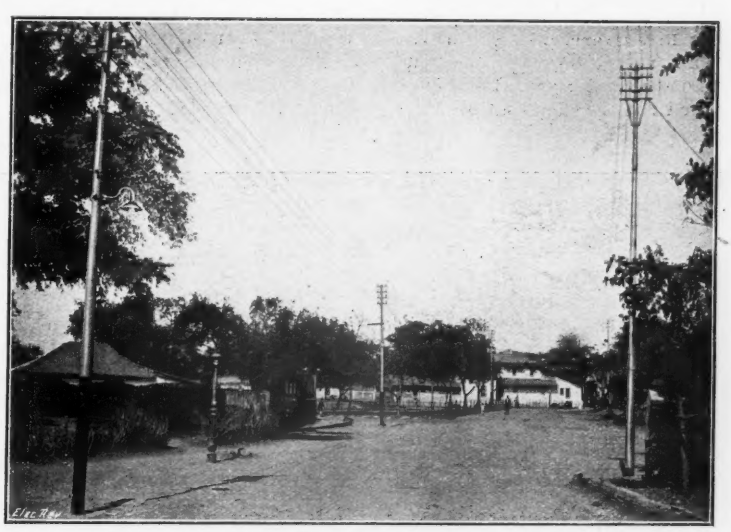
The site of the recent extensions is on a hillside, and some 2,900 tons of spoil were removed to level the site. This work, together with the foundations, brickwork, &c., was carried out under the direction of the borough engineer, while the new plant was, of course, installed under the supervision of Mr. Ellis, the borough electrical engineer, to whom we are indebted for these particulars.

ELECTRICITY SUPPLY AT AHMEDABAD, INDIA.

THE city of Ahmedabad, which is one of the most important in the Bombay Presidency, with a population of approximately 250,000, has now been provided with a modern electricity supply undertaking.

The company was floated by Messrs. Killick, Nixon and Co., Bombay, to whom the population of Gujarat is indebted for the advantages of railway communications in many of the outlying districts. The contractors were Messrs. Callender's Cable and Construction Co., who carried out the whole of the cable work, whilst Messrs. Crompton and Co. were the sub-contractors to them for the whole of the plant inside the generating station.

The buildings are constructed of brick, the roof being boarded with teak inside, and covered on the outside with corrugated asbestos sheets.

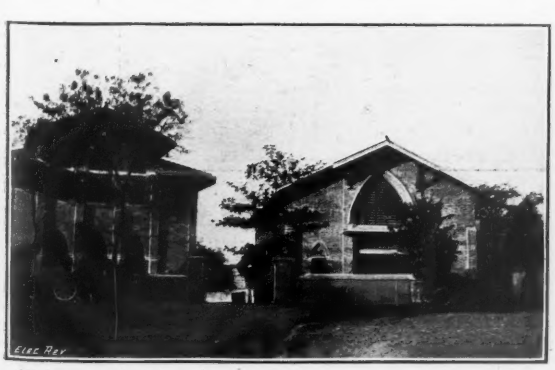


OVERHEAD DISTRIBUTION, STREET LIGHTING, &C., AHMEDABAD.

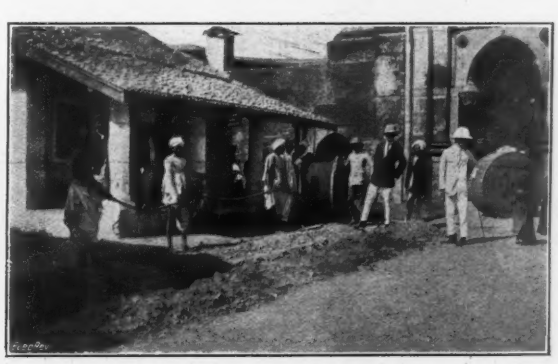
The plant installed consists of three 150-B.H.P. Diesel oil engines supplied by Messrs. Mirrlees, Bickerton and Day, each coupled to a three-phase Crompton-alternator of 94-KW. capacity, and capable of developing its rated output at 3,000-3,300 volts, 50 cycles; each alternator has a direct-coupled exciter.

The starting air bottles for the engines are interconnected, enabling any set of bottles to be charged up from another set, or an engine to be run off either set of bottles.

A 50-KW. 3-phase 3,000/3,300 to 400-volt step-down transformer of the oil-cooled type is installed in the station, and



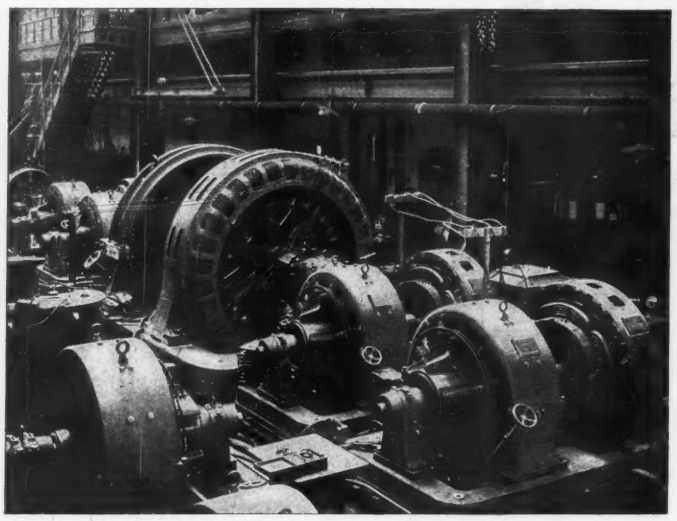
GENERATING STATION AND BUNGALOW.



LAYING H.T. CABLES, AHMEDABAD.

is provided with tappings and switchgear to enable the low-tension supply to be regulated to deal with an increased voltage on the bus-bars, to provide for pressure drop in the outgoing feeders.

Two Heenan & Froude water coolers are provided, each capable of dealing with the whole of the circulating water from two 150-B.H.P. engines running together at full load; these are driven by 7-H.P. motors, and the temperature of the water is reduced about 20°. This circulating water is taken from the town mains, and is supplied to the engines from a 1,500-gallon tank placed on the cooler house roof. A boiler of 5,000 gallons capacity has been provided for storing the oil fuel, which is pumped up from this to a 100-gallon tank in the generating station, and distributed to the supply tanks of the engines. The oil is supplied by the Anglo-Persian Oil Co., who have installed oil tanks near the city.



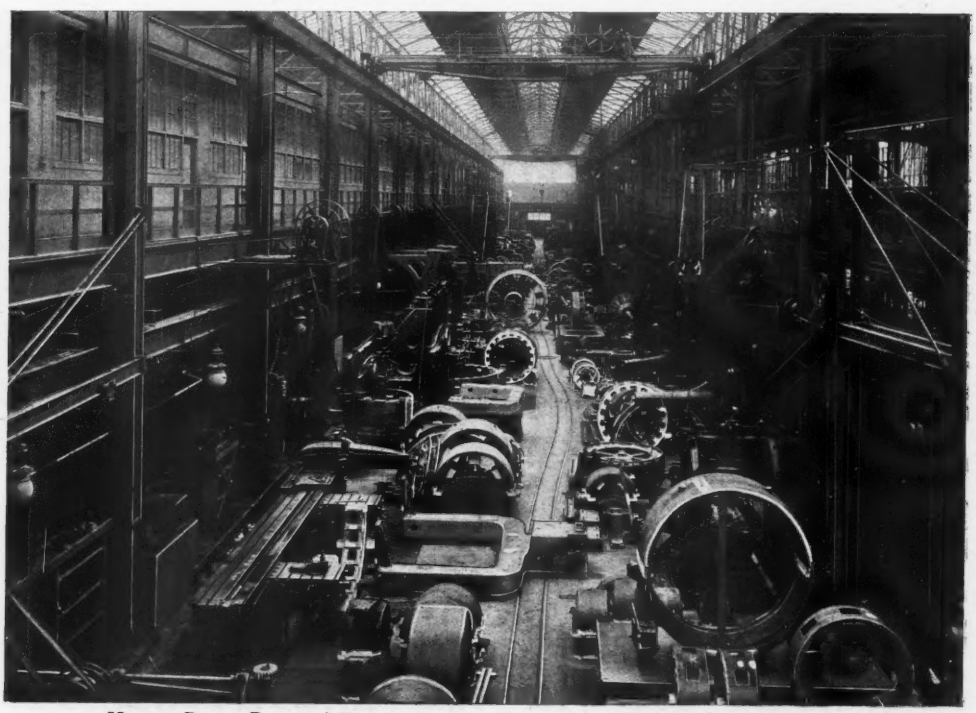
Messrs. Bruce Peebles' Works. Fig. 1.—Heavy Testing Department (see p. 697).

The high-tension switchboard is built of marble panels on a steel framework, with the H.T. gear behind, and the L.T. gear, which controls the L.T. side of the transformer and three outgoing distributors, on the front; an overhead 5-ton hand-crane has also been erected in the engine room. The H.T. transmission is carried out on the three-phase system, at 3,300 volts between phases, the cables being run to three transformer pillars in the town, two of which each contain one 25-KW. three-phase, 3,000/3,300 to 400 volt step-down transformer, and the third one a 50-KW. transformer of the same type. The underground cables in use are ·025 sq. in. three-core, lead-covered, steel-tape armoured H.T. mains; and ·05, ·05, ·05, ·025 sq. in. four-core, lead-covered, steel-tape armoured L.T. distributors.

The distribution is carried out on the three-phase four-wire system, with 400 volts between phases and 230 volts between each phase and neutral, the neutral being earthed at the point of supply. Both overhead and underground mains are used, the former consisting of three No. 6 S.W.G. and one No. 8 S.W.G. hard-drawn copper wires. A special safety device has been fitted, which consists of rings of bare copper wire earthed and fixed at a distance of 2 ft. from the insulators, through which each live wire passes, leaving a clearance of 3 in., so that should a live wire break it immediately comes in contact with the earthed ring, and is rendered harmless.

Where possible, overhead bare copper wire services are run to the consumers' premises, but many consumers are being connected by means of lead-covered 4-core cable which is run along a row of buildings and tappings taken off; underground services are also in use in some places where the distribution cable is run underground.

An agreement has been entered into with the municipality to take a supply of electricity for street lighting for 15 years, the maintenance being carried out by the company.



Messrs. Bruce Peebles' Works. Fig. 2.—Main Bay of Machine Shop (see p. 697).

The wires are run on the distribution system poles, and the lamps, which are of 100 C.P. and 50 C.P., are fixed in water-tight brackets at a distance of approximately 12 ft. from the ground and 40 yards apart. These lamps are controlled from three cast-iron control pillars, and arrangements have been made for switching off or on one-half of the lamps when required.

The present rates for the supply of electricity are 6 annas per unit for lighting and fans, and 2 annas per unit for power.

A considerable demand for electricity is expected from private residences, mosques, hospitals, flour and oil mills, offices, railway station yards, and fans, and for pumping purposes.

In conclusion, we are indebted to Mr. R. Forest Preston, engineer and manager to the Ahmedabad Electricity Co., Ltd., for enabling us to publish these particulars and views of an interesting plant.

THE WORKS OF MESSRS. BRUCE PEEBLES AND CO., LTD.

The name of Bruce Peebles at once suggests "motor-converters," owing to the great popularity achieved by these ingenious machines; but the output of the large works on the Firth of Forth is by no means confined to this class of apparatus, the firm's manufactures including A.C. and D.C. motors of powers from 1 to 3,000 H.P., and generators of various types, for driving by steam and hydraulic turbines, and steam and gas engines, up to 5,000 KW. Some particulars of the works are given in an illustrated brochure recently issued by the company, from which we reproduce the accompanying views (on page 696).

The site of the works covers 10 acres, and is provided with excellent facilities for the transport of goods by sea and land, the works being connected with the Caledonian Railway system, which passes the premises, by means of sidings on which electric locomotives run. An artesian well provides a good supply of water.

The main building is 600 ft. long × 150 ft. wide, and is divided into five bays, of which the centre one (fig. 2) is devoted to the large machine tools and heavy erecting work. Power is supplied by a 500-KW. Peebles-Belliss set and a 250-KW. Peebles-Browett set, each engine driving two dynamos so as to feed a three-wire system at 230 and 460 volts, in conjunction with a Tudor storage battery. A gas producer for heating purposes and air compressors for pneumatic tools are installed, and the works are well provided with electric cranes and hydraulic hoists. Lighting is effected with metallic-filament lamps of high candle-power.

The heavy machine tools include a 20-H.P. planing machine, an 18-ft. side planer, and a 20-ft. boring mill, as well as a variety of smaller tools and automatic machine tools. Stamping and notching tools for accurate work up to the largest sizes of core plates are installed, and a special patented continuous process is employed for insulating and stoving the plates, which go into one end of an oven uninsulated and come out at the other end dry and ready for assembly.

The fitting and connecting-up of the windings are carried out by a separate department, great care being devoted to this work. The winding department is divided into separate sections for D.C. armatures, A.C. rotors and A.C. stators; the larger machines, however, are wound at one end of the main bay, in order that they may be handled by the large travelling cranes.

Vacuum varnishing tanks are provided for impregnating the windings, together with drying ovens, which are fitted with doors opening into the main shop, so that the finished work need not be carried back through the varnishing room.

The foundry deals with castings of brass, gun-metal, aluminium, &c., and is also used for a patented process by which rings of special alloy are cast on the rotor conductors of the Peebles squirrel-cage induction motors, instead of riveted and soldered copper rings.

Testing departments are provided near the power house, but the heavier machines are tested in the main bay, under the cranes, as shown in fig. 1. In this view a number of Peebles-la Cour patent motor converters are shown, including the large set of 2,200 KW. for Manchester Corporation, which we illustrated in our issue of November 27th, 1914.

The offices are accommodated in a large building near the works, and exceptionally adequate provision is made elsewhere for the comfort of the employés, a large dining-room and kitchen being placed at their disposal, where excellent meals are supplied at low prices.

Needless to say, the firm are very busy with private orders as well as with Government work; they are somewhat handicapped by the scarcity of labour, some 150 of their employés having joined the Colours, but every effort is being made to cope with the demand.

BRITISH INDUSTRIES FAIR.

The Board of Trade British Industries Fair, which has been organised by the Commercial Intelligence Branch of the Board as one part of the programme for assisting firms to capture enemy trade, was opened last Monday. Her Majesty the Queen, with whom we observed Mr. Runciman, President of the Board, Sir H. Llewellyn Smith, and prominent members of the staff who have taken an active part in organising the exhibition, made a tour of the Hall, and stopped at many stands to take an interest in particular exhibits. There are some 600 stands, and the exhibition, which has been arranged purely for trade buyers, will remain open until May 21st.

Invitations to Continental buyers were issued some time ago, and we understand that many of these, as well as some from Canada, America, and other distant countries, have already visited the Fair. The trades to which it was found necessary to restrict the Fair are:—China, earthenware and glass, cutlery, electro plate, printing, stationery, jewellery (including drapers' jewellery and haberdashery), toys and games, and fancy goods—all trades in which a large proportion of the goods hitherto consumed in this country have been imported from abroad. All of the exhibiting firms are manufacturers, and they, consequently, represent British industry more thoroughly than would be the case had factors and wholesale dealers been included in the total.

The support which manufacturers have given to the movement may be gathered from the fact that the 600 exhibitors have only been allotted space by considerably reducing the sites applied for in the majority of cases. The Board of Trade are endeavouring to assist buyers as far as possible, and interpreters have been engaged, special Inquiry Offices organised in each of the trade sections, and a branch of the Commercial Intelligence Branch of the Board of Trade established in the Hall, so that the fullest information on such matters as commercial statistics, Customs tariffs, shipping and transport, commercial products, and similar matters may be at the disposal of exhibitors and visitors. Any buyer who has not received a ticket and desires one should communicate at once with the Branch, at 32, Cheapside, E.C.

The following are among the exhibitors:—

Arctic Light Co., Ltd.	Artistic lighting for tables, rooms, &c.
Bassett-Lowke, Ltd.	Model electric locomotives and electric motors.
Baxter, T.	Electrical novelties.
J. Bourne & Son	Insulators, battery jars, electrical goods.
British Glass Wool Co.	Glass wool for electrical trades.
Barge, Warren & Ridgeley, Ltd.	Small vulcanite turnery for electrical instrument trade.
J. Burns	Vulcanised fibre insulating parts for electrical toys.
Burkes, Tate & Co.	Glass globes for electric lighting.
Chance Bros. & Co., Ltd.	Glass for scientific instruments.
A. & R. Cochran	Glass for electric lighting.
Corbett & Co., Ltd.	Glass tube, cane and bulbs for electric lighting.
F. Darton & Co.	Small electric motors and dynamos.
A. & J. Davies, Ltd.	Glassware for electric lighting.
Economic Electric, Ltd.	Small electric motors, amateur electrical material, &c.
Efandem Co., Ltd.	Pocket lamps, dry batteries, motor-car lighting sets, &c.
Electro Galvanisers, Ltd.	Electro-galvanising, electro-deposition, &c.
Endolithic Manufacturing Co., Ltd.	Ivory, metal and other nameplates.
Fleming, Joseph, & Co.	Electric light glass shades.
Henry Harvey & Co.	Electric light reflectors.
Houghton-Butcher Manufacturing Co., Ltd.	Engineers' drawing boards.
Improved Solidite Co.	Material for moulded insulators for electrical purposes.
Leeds Fireclay Co., Ltd.	Firebricks.
Maxfield & Sons (Silversmiths) Ltd.	Electric kettles.
Molineaux, Webb & Co., Ltd.	Electric light globes and shades.
New British Ever-Ready Co., Ltd.	Dry cells, pocket lamps, electrical specialities.
F. and C. Osler, Ltd.	Electric light shades, glass electroliers, and metal E.L. fittings.
Pilkington Bros., Ltd.	Glass shades, electric storage battery cells, &c.
Pitkin, Jas., & Co.	Clocks, electric batteries and lamps, recording instruments, &c.
Pytram Manufacturing Co.	Electric lighting fittings.
Richardson, H. G., & Sons	Glass electric fittings.

Silent Electric Clock Co., Ltd.	Electrically-controlled clocks.
Stevens & Williams, Ltd. ...	Electric light glass shades.
Stocal Enamelled Tile and Iron Co., Ltd.	Electric light reflectors.
Storer, T. N., Sons & Co. ...	Electric lamp shades.
Surrey Electrical Co., Ltd. ...	Pocket lamp batteries and lamps, electric toys, wireless instruments, &c.
Synchronome Co., Ltd. ...	Electrically-controlled clocks.
Syrolit, Ltd.	"Erinoid," a British substitute for "Galalith," for electrical and telephone fittings.
Technical Engineering Co., Ltd.	Toy vertical steam engines.
Ward & Goldstone	Pocket, hand and portable lamps, magneto machines, dry batteries, instruments, model motors and dynamos, wireless apparatus, &c.
Wiggin, H., & Co., Ltd. ...	Electrical resistance wires and strips.
Wolff, Henry, & Co.	Electric lamp shades.
Wood, F. G.	Dials for electric meters.

NOTES.

Institution and Lecture Notes. — Institution of Electrical Engineers.—The report of the Students' Section for the past session shows that there have been six general meetings in London, nine at Manchester, and four at Newcastle. Visits and social functions had been arranged at the close of last session, but owing to the outbreak of war it was found necessary to cancel the whole of the arrangements. It was not found possible to commence the session in London until January, and since that date a somewhat curtailed programme has had to be followed. The Manchester Section was able to carry through a full sessional programme, and the Newcastle Section found it necessary to suspend a portion of its programme. The Scottish Section decided to suspend all the meetings for this session on account of the depleted membership.

At the meeting of the Yorkshire Local Section, on Wednesday last, Mr. J. H. Rider's paper on "The Power Supply of the Central Mining-Rand Mines Group," was read and discussed.

The Textile Institute. — Sir William Mather, of Messrs. Mather & Platt, Ltd., Manchester, was elected President of the Textile Institute at the annual meeting in Manchester last Friday. He remarked that the double aspect of our duty at the present time was to beat the enemy at the front and to prepare for the future so as to avoid a fearful accumulation of debt and difficulty that it might take a generation to overcome. The time had come when we must throw overboard all those old-fashioned notions of ours that England was a favoured nation by the grace of God, and that Englishmen had, as a birthright, a higher position in the world than the people of any other nation. England could improve on the past in many ways. What they needed to do was to bring the light of science and higher education to bear more than they had done.

Institute of Marine Engineers. — The Hon. Secretary announces that the Institute has been removed from the premises in Romford Road to those on Tower Hill, and all communications should therefore be addressed as follows:—The Secretary, the Institute of Marine Engineers, the Minories, Tower Hill, London, E.

Educational.—A new edition of the University College, London, "Pro Patria" is in course of preparation, and will be issued shortly. Past and present students, or their relatives and friends on their behalf, are invited to send full particulars of the capacity in which they are serving the country at the present time. In the case of the Army, rank and regiment should be given; in the case of the Navy, rank and ship. These particulars should be addressed to the Publications Secretary, University College, London (Gower Street, W.C.).

Gift to Sheffield University.—The *Times* states that Sir Joseph Jonas, chairman of the Applied Science Committee of the University of Sheffield, has given the University £5,000 to found, endow and equip a testing laboratory in connection with the Applied Science Department. The laboratory is to be equipped with the most modern appliances for testing metals and minerals, especially those used in the production of steel, and is to be called the "Jonas Testing Laboratory."

Electrical "Evaporation."—Prof. Owen Richardson delivered the Friday evening discourse at the Royal Institution on May 7th, his subject having to do with the electron theory, to which he has devoted a great deal of special study. He pointed out that when electrified bodies were heated they lost their power of retaining an electric charge. The importance of this phenomenon was only just being realised, although the phenomenon itself had been known for a long time. Under certain conditions this ionic emission was positive in character, under others negative, and under others, again, was both positive and negative. When, however, a metal was heated in a vacuum, like the filament in a lamp, it was found that under all conditions of temperature only negative charges were emitted; the heated filament gave off no positively electrified particles. Prof. Richardson went on to develop a theory that the emission of streams of electrons from heated metals was a process closely analogous to evaporation. It seemed to him to be the electrical analogue of evaporation, or, to put it more simply and daringly, the actual evaporation of electricity. There were some remarkable parallels between the evaporation of a liquid and the emission of electrons from a lamp filament, and the lecturer proceeded to demonstrate experimentally that the electrons were able to flow against an opposing electric field, and in effect to jump a certain number of volts. There was a possibility that minute chemical products might be sufficient to account for the electrical effects in a large number of cases. Fortunately, however, there was one case in which it had been found possible to demonstrate electrical effects of this kind out of all proportion to the chemical effects. This was the instance in which the metal employed was tungsten, which could be heated in a tube for so long a time, and carried to so high a temperature, that all known impurities were eliminated, and, by using specially prepared tungsten lamps, it was shown conclusively that these effects were strictly electrical emissions, and were not to be explained on the ground of chemical action. In conclusion, Prof. Richardson expressed his belief that these emissions of electrons from heated bodies were large enough to have very considerable practical importance in the future.

Stowmarket Explosion.—An explosion took place on Monday last at a Stowmarket factory, resulting in the death of four men. At the inquest on Tuesday Major Aston Cooper Key, one of H.M. Chief Inspectors, advanced the view that one of the men, who wore rubber overshoes, had become charged with static electricity by friction with certain bags, and that a spark passing from his body to some earthed object had caused the explosion. To prevent a recurrence of the accident a metal stud would, in future, be inserted in the sole of the shoe, so that the worker would always be earthed. No fatal accident had previously occurred at the factory since it was started, 17 years ago. The jury returned a verdict of "Accidental death."

British Electrical Trade in Belgium.—A Belgian correspondent now in this country, who has had 16 years in connection with the electrical industry, wants to assist in the defeat of German competition in Belgium after the war is over, and to help to encourage a large volume of British electrical trade there. He wishes to become the general representative for some English manufacturers of motors, dynamos, wire, cable, lamps (arc and incandescent), dry batteries, &c. We shall be pleased to forward any communications that may be received addressed to "Belgian Correspondent," care of Electrical Review.

Fatalities.—Owing to the heavy rainfall and the flood on the railway near West Kensington, last week, an employé of the District Co., named A. J. Lawrence, lost his life. The man, a gateman, in stepping from a train into the water received a severe electric shock and died an hour later.

At the inquest on Tuesday it was stated that the conductor warned Lawrence not to get into the water on account of the electric current, but later he did so. A passenger who jumped into the water to help him received a shock, but was able to rescue the deceased. Artificial respiration was tried for 2½ hours without success. The medical evidence showed that death was due to shock and not to drowning, and a verdict of accidental death was returned.

The Manchester Meeting of the B.A.—The meeting of the British Association will open on Tuesday, September 7th, and close on Saturday, September 11th.

Inquiries.—Makers of Mascolite pads for absorbing vibration are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Wolverhampton T.C. has been recommended to increase the salaries of the undermentioned officials in the electricity department:—Mr. T. Smith, distribution engineer, from £245 to £270 a year; Mr. E. Forder, engine-room superintendent, £150 to £165; Mr. C. Bellhouse, boiler-house superintendent, £150 to £165; Mr. E Stubbs, chief assistant, from £200 to £225; Mr. J. H. Rothwell, chief clerk, £170 and £183. The increases are to take effect as from April 1st last, with no further increases for four years as regards the chief assistant, distribution engineer, chief clerk, and for two years as regards the two superintendents.

The Newport (Mon.) Electricity and Tramways Committee has recommended that the salaries of Messrs. E. G. Illingworth and C. B. Briggs, senior engineers in charge at the electricity works, be increased to £123 10s. per annum.

Mr. A. B. Adams, draughtsman and general technical assistant at the Newport (Mon.) Corporation Electricity Works, has secured an appointment with Messrs. Gu s', Keen & Nettlefold, Ltd.

Mr. R. S. Gregg has resigned his position as assistant in the mains department of the Sheffield electricity undertaking.

Tramway Officials.—Mr. C. Beech, rolling stock superintendent in the Derby Corporation tramways department, has been appointed car-shed superintendent at Bolton, at £200 per annum. There were 93 applicants.

General.—After nearly six years in the East, during the last nine months of which he has been officiating as electrical inspector to the Government of Burma, Mr. HARRY W. NIMMS was to leave Rangoon for home by the ss. *Leicestershire* on April 29th.

MR. GEORGE HUTCHINSON, chief electrician of the *Lusitania*, interviewed at his home at Frodsham, Cheshire, stated that he had just given his life-belt to a young woman when he saw Mr. Vanderbilt struggling in the water. The millionaire's lifebelt was wrongly adjusted, and Hutchinson, who was treading water, tried to put it right, but could not. "I am Vanderbilt," the struggling man remarked to him. He did his best to keep both of them afloat, but they drifted apart.

The Bacup Town Council recently accepted the resignation of MR. W. E. LLOYD, borough treasurer and manager of the electricity department, who has been appointed borough accountant of Hampstead, at a commencing salary of £450 per annum. The Mayor said that after Mr. Lloyd was appointed treasurer he was appointed manager of the electricity department, and received some additional salary for it, and they would probably proceed on similar lines in regard to a successor. Ald. Maden said that as regards the electricity department, it had made rapid strides since Mr. Lloyd went to Bacup.

On March 25th, at St. Augustine's Church, Doornfontein, MR. J. H. DOBSON, general manager of the gas, electric supply, and tramways department of the Johannesburg Corporation, was married to Miss Kathleen Florence Cherrington, third daughter of Major and Mrs. Cherrington. The ceremony was performed by Canon Harrison Thompson. A reception followed at the County Club, 500 guests being present. Mr. and Mrs. Dobson were the recipients of many presents, including a massive silver punch bowl from the chief officials of the department, a grandfather's clock and silver fruit epergne from the staff and employés, a silver fruit stand and silver vases from the motormen and conductors, and a silver rose bowl and case of carvers from the traffic inspectors. The Mayor and Mayoress sent a silver tea service.

Obituary.—DR. F. S. PEARSON.—We deeply regret to record that Dr. F. S. Pearson, who was so prominently identified with a large number of important Mexican, Brazilian and European electrical undertakings, was among those who were lost in the *Lusitania* on Friday last. He had also brought his brilliant organising powers and financial knowledge to bear upon several non-electrical enterprises, but our readers will remember him as president of the Brazilian Traction, Light and Power Co., Rio de Janeiro Tramway, Light and Power Co., Mexican Light and Power Co., the Mexico Tramways, and the Barcelona Traction, Light and Power Co. He was a director of the Sao Paulo Tramway, Light and Power Co. and the Mexico Electric Tramways. As will be seen from a report appearing in our "City Notes," he was on his way to this country to attend a meeting of the Barcelona company mentioned above.

MR. AUDLEY DRAKE.—We are also grieved to learn that amongst the *Lusitania* victims was Mr. Audley Drake, aged 24, the elder son of Mr. Bernard Drake, Copyhold, Cuckfield, Sussex, chairman of Drake & Gorham, Ltd., with whom widespread sympathy will be expressed by his friends in the electrical industry. Mr. Audley Drake was educated at Eton, and King's College, Cambridge, where he specialised in science. After four years at Cambridge he went last June to America to study an electrochemical process, which is being worked on a large scale near Detroit. Whilst there he obtained a responsible appointment with the United Alkali Co., of Liverpool, who are now putting down a large plant, having acquired the British rights for the above invention. Mr. Drake was to have returned later, but owing to the fact that the products were urgently wanted by the Government in connection with the manufacture of explosives, he received a cable to come back as quickly as possible, hence his unfortunate inclusion amongst those lost on the *Lusitania*. His father tells us that he had little hope from the first as he was certain his son would never leave the ship as long as there was anyone there to whom he could render assistance.

MR. G. MAURICE.—It seems from what we hear that Mr. G. Maurice, of the General Electric Co., Ltd., has likewise been lost in the *Lusitania*, but in the hope that there may yet be good news, we refrain from referring to the matter further this week.

The electrical world also suffered a further loss through this infamous outrage of the enemy, MR. GORER, a director of Venner's Cookers, Ltd., being among the drowned.

MR. H. F. FRIEDRICHS.—The death occurred on Sunday night of Mr. H. F. Friedrichs, the borough electrical engineer at West Hartlepool. Mr. Friedrichs first went to West Hartlepool in 1889 as Sir Alex. B. W. Kennedy's representative in connection with the initiation of the Corporation electricity undertaking, and later was appointed borough electrical engineer, a position he has since filled. His work in connection with the installation of the waste heat plant, by means of which the waste steam from the Seaton Carew blast furnaces is utilised for the generating of electric current, was specially valuable. Mr. Fredericks was 50 years of age, and was born at Penang, in the Malay Peninsula. He leaves a widow and five children.

MR. J. S. NAYLOR.—The death is notified, at the age of 72 years, of Mr. Jas. Smith Naylor, who was a director of the Keighley Electrical Engineering Co., Ltd., from its formation.

MR. HARRY CROXON HAWKINS, for 25 years a member of the staff of Crompton & Co., Ltd., electrical engineers, died at his residence at Chelmsford on May 6th, from cerebral hemorrhage. Deceased, who was 53 years of age, became the firm's chief accountant at both the Chelmsford and London offices.

The death is announced of MR. D. FALL, manager since its inauguration of the Portrush and Giant's Causeway Electric Tramway.

NEW COMPANIES REGISTERED.

Tyneside Alloys, Ltd. (140,245).—This company was registered on May 7th, with a capital of £10,000 in £1 shares, to carry on the business of extracting metals and their compounds from ores and other substances, making alloys of all kinds, including tungsten, molybdenum, vanadium, chromium, and ferro-alloys used in the manufacture of steel and other industries, manufacturing heavy and fine chemicals and enamelling, colouring, and dyeing substances, manufacturing, treating, distilling and refining tars, coal tar products, and other substances, manufacturing and dealing with gases, extracting, refining, and hardening oils of all kinds, prospecting, mining, etc. The subscribers (with one share each) are: W. Jones, Ingleside, Gosforth, Newcastle-on-Tyne, metallurgist; A. Y. Jones, Netherhoys, Gosforth, Newcastle-on-Tyne, brick manufacturer; D. S. Jones, St. Bedes, East Boldon, brick manufacturer. Private company. The first directors are W. Jones, A. Y. Jones, and D. S. Jones. Qualification, 100 shares. Remuneration as fixed by the company. The directors may borrow up to £10,000 without the sanction of a general meeting. Solicitors: Wilkinson and Marshall, 1, Mosley Street, Newcastle-on-Tyne.

Francis Polden and Co., Ltd. (140,231).—This company was registered on May 7th, with a capital of £5,000 in £1 shares, to carry on the business of electrical and mechanical engineers, manufacturers of machinery of all kinds, tool makers, founders, metal workers, etc., and to adopt an agreement with F. C. Polden. The subscribers are: F. C. Polden, 56, Cannon Street, E.C., electrical and mechanical engineer, 2,500 shares; C. J. Polden, 56, Cannon Street, E.C., electrical engineer, 10 shares. Private company. The number of directors is not to be less than two or more than five; the first are F. C. Polden (permanent chairman and managing director) and C. J. Polden. Qualification, £10. Registered office: 56, Cannon Street, E.C.

Anglo-Burmah Wolfram Syndicate, Ltd. (140,174).—This company was registered on May 4th, with a capital of £500 in £1 shares, to carry on the business of dealers in and treaters and smelters of wolfram ore, etc. The subscribers (with one share each) are: E. Boundy, 5, Fen Court, Fenchurch Street, E.C., merchant; C. C. Nichols, Ocean House, 24 and 25, Great Tower Street, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered office: Ocean House, Great Tower Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Autoelectric Transmission, Ltd.—Debenture, dated April 15th, 1915, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: A. A. Knight, 2, Corfton Road, Ealing, W., and H. L. Mocatta, 39, Edwardes Square, Kensington.

Jarrow and District Electric Traction Co., Ltd. (78,680).—Capital, £50,000 in £1 shares. Return dated March 15th, 1915. All shares taken up. £1 per share called up; £49,961 15s. paid (including £16 15s. paid on 55 shares forfeited), leaving £38 5s. in arrears. Mortgages and charges, £14,800.

North-Eastern Electric Smelting Co., Ltd.—Mortgage, dated April 16th, 1915, to secure £6,250 any further moneys which may be advanced or become owing, charged on premises in Wallsend and the company's undertaking and property, present and future, including uncalled capital. Holder: Secretary of State for War.

Melton Mowbray Electric Light Co., Ltd. (53,018).—Registered June 18th, 1897. Capital £25,000 in £5 shares. Return dated March 10th, 1915. 4,000 shares taken up; £20,000 paid. Mortgages and charges, £19,500. Registered office: 35, Regent Street, Melton Mowbray.

Electric Zinc Co., Ltd. (127,838).—Capital, £2,000,000 in £1 shares (400,000 pref. and 1,600,000 ord.). Return dated December 31st, 1914. Seven shares taken up; nothing called up. Mortgages and charges: Nil.

G. H. Turner and Co., Ltd.—Issue on April 21st, 1915, of £80 debentures, part of a series of which particulars have already been filed.

Newcastle and District Electric Lighting Co., Ltd. (28,022c).—Capital, £300,000 in £10 shares. Return dated March 19th, 1915. All shares taken up. £297,500 paid, leaving £2,500 in arrears. Mortgages and charges: £320,780.

Kensington and Knightsbridge Electric Lighting Co., Ltd. (26,193).—Capital, £350,000 in £5 shares (50,000 ordinary, 10,000 1st pref. and 10,000 2nd pref.). Return dated March 18th, 1915. 21,000 ord., 10,000 1st pref., and 10,000 2nd pref. shares taken up. £5 per share called up on 15,968 ord., 10,000 1st pref., and 10,000 2nd pref. shares; £179,840 paid; £35,160 considered as paid on 5,032 ordinary shares. Mortgages and charges: £115,000. Stock issued by this company in conjunction with the Notting Hill Electric Co., Ltd., £231,600.

British L. M. Ericsson Manufacturing Co., Ltd. (79,061).—Capital, £200,000 in £1 shares (99,990 pref. and 100,010 ord.). Return dated March 31st, 1915. All shares taken up. £1 per share called up on 50,010 ord., 8s. per share on 50,000 ord., and £1 per share on 99,990 pref. shares; £170,000 paid; £30,000 (12s. per share) considered as paid on 50,000 ord. shares. Mortgages and charges: £50,000.

Mather and Platt, Ltd. (60,387).—Capital, £1,000,000 in 40,000 pref. shares of £10 each, and 600,000 ord. shares of £1 each. Return dated March 13th, 1915. All shares taken up. £10 per share called up on 29,200 pref. and £1 per share on 25,000 ord. shares; £317,000 paid; £683,000 considered as paid on the remainder. Mortgages and charges: Nil.

Hellyar and Sons, Ltd.—Second debenture, dated April 24th, 1915, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital, subject to prior debenture on which £436 remains owing. Holder: Mrs. K. F. Galton, 68, Church Road, Barnes.

Resisto-Electrical Manufacturing Co., Ltd.—Particulars of £5,000 debentures, created April 12th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £400. Property charged: The company's undertaking and property present and future, including uncalled and unpaid capital. No trustees.

Oriental Telephone and Electric Co., Ltd.—A memorandum of satisfaction to the extent of £2,400 on April 14th, 1915, of deb. stock covered by trust deed dated June 28th, 1905, and a supplemental deed of acknowledgment dated June 12th, 1907, securing £200,000, has been filed.

British Electric Automatic Machines, Ltd.—Debenture and agreement in connection therewith, both dated April 12th, 1915, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Kleinwort, Sons & Co., 20, Fenchurch Street, E.C.

CITY NOTES.

Barnsley and District Electric Traction Co., Ltd.

The report, submitted at the annual meeting held on Tuesday at the Electrical Federation Offices, W.C., showed that the revenue for the year was £27,586. After providing for all expenses chargeable to revenue, including £1,756 for debenture and loan interest, and setting aside £3,500 to the renewals account, there is a surplus, including £376 9s. 4d. brought forward, of £4,066. The dividend on the 6 per cent. preference shares absorbs £1,320, 6 per cent. on the ordinary share capital requires £1,202, and £1,544 is to be carried forward. The capital expenditure during the year was £7,520, mainly for additional motor omnibuses and further garage accommodation.

	1913.	1914.
Passengers carried	2,462,557	2,950,335
Average receipts per passenger	1.65d.	2.12d.
Average expenditure per passenger	1.00d.	1.51d.
Proportion of expenses to receipts	60 p.c.	71 p.c.
Cars in stock	14	14
Motor omnibuses in stock	10	20

British Thomson-Houston Co., Ltd.

Mr. Geo. Franklin presided on Wednesday, at 83, Cannon Street, E.C., over the annual meeting of the company.

The Chairman, in moving the adoption of the report, said it was so complete in the information about the company's affairs that only very little remained for him to say. The year past had been a most difficult one, and if they were able to put before the shareholders a satisfactory balance sheet, it was greatly due to the loyal and efficient way in which the whole of the staff had done their work; and, on behalf of the Board, he tendered to them, one and all, their most sincere thanks, feeling sure that the shareholders would join cordially in this sentiment. As mentioned in the report, a great many of their employés had joined His Majesty's Forces, and they had made suitable provision for their families during the time they were serving their King and country. With regard to the disposal of the net profit for the year, which showed an increase of about £11,000 over 1913, they had, after consultation and in agreement with the most important shareholders, decided to utilise the same as shown in the balance sheet, and thereby further strengthen the position of the company.

Mr. W. C. Lusk (manager, commercial department) seconded the motion, which was carried without discussion.

Callender's Cable and Construction Co., Ltd.

In their report for 1914, the directors state that the accounts show a balance at the credit of profit and loss of £98,692, plus £124,591 brought forward, making £223,284. Interest on debenture stock absorbs £13,500, dividend on preference shares £10,000, depreciation of buildings, plant and machinery £9,968, depreciation of office furniture £397, leaving an available balance of £189,419. It is proposed to pay a dividend on the ordinary shares at the rate of 10 per cent. per annum, less income tax, being 10s. per share, whereof 5s. less income tax, was paid on November 2nd, 1914, and 5s., less income tax, will be paid on May 21st, 1915, to pay a bonus of 5s. per share, less income tax, and to carry forward £163,169. The directors consider this result to be satisfactory. It has been arrived at in spite of the disorganisation of business by the war during five months of the year, in which period operations were carried on with great difficulty and at considerably increased cost. All the departments of the company's factory were profitably engaged to their utmost capacity up to the end of July last, but on the declaration of war much of the business in hand was stopped, and it can easily be understood that the position thus created caused the gravest anxiety to the directors and management. Several of the contracts secured in the early part of the year were postponed, and others were only partially completed, but after three months' uncertainty it was found possible to reorganise the factory to meet the altered conditions of the trade, with the result that the works at Erith are now busy in some of their departments and well occupied in the others. Considerable trouble has recently been experienced in regard to labour, and the situation still remains unsettled. The curtailment of facilities for transport by land and sea has added materially to the difficulties of satisfactory manufacture. Shortly after the outbreak of hostilities special orders of some importance were placed with the company by the Admiralty and the War Office. Owing to the re-arrangement of plant and machinery necessary to execute this work, comparatively little of it was completed at the expiration of 1914, and practically no profit has yet accrued to the company through these war contracts. As was inevitable with the widespread interests of the company, heavy expenses and great inconvenience were caused in connection with the oversea business hitherto carried on, but, considering the unprecedented circumstances, this trouble has been less than might reasonably have been anticipated. Every opportunity has been taken to extend the company's operations wherever possible, and the directors feel confident that, when peace is again restored and commerce has resumed its normal course, a large and increasing business may be looked for, not only in those countries in which the company is already established, but also in several new localities. Important contracts in connection with the British telephone system, to which reference was made in last year's report, were placed in this company's hands in the early part of the year, and, in order to deal efficiently therewith, some expenditure on contract plant was incurred. The war has for the moment caused a suspension of all telephone extension, but this work will without doubt be resumed when the war has ceased. As usual, all plant and appliances have been thoroughly maintained and kept up-to-date, and the expenses so incurred have been charged against the year's accounts. The Anchor Co., in which this company holds a large interest, has again had a prosperous year, and continuous progress is being made in the various electrical undertakings in which this company is concerned. The company has arranged to make allowances to the dependents of its employés engaged on active service, and a new item therefore appears in the accounts. The amount for the current year will, however, be much larger than that shown in 1914, as the number of recipients is constantly increasing.

Annual meeting: May 20th.

Peterborough Electric Traction Co., Ltd.

The annual meeting was held on Tuesday at Electrical Federation Offices, W.C. The report submitted showed that the revenue for 1914 was £10,967. After deducting expenses, £8,608 16s. 10d., chargeable to revenue and debenture interest £945, there remains £1,413, plus £106 brought forward. £1,263 is to be applied to renewals fund, leaving £257 to be carried forward. £979 was expended on capital account during the year, mainly upon the purchase of motor omnibuses and on garage accommodation. Mr. R. J. Howley has been appointed a director of the company.

	1913.	1914.
Tickets issued	1,478,805	1,508,947
Average receipts per passenger	1.19d.	1.16d.
Average expenses per passenger	.78d.	.84d.
Proportion of expenses to receipts	65 p.c.	72 p.c.
Cars in stock	14	14

Amalgamated Wireless (Australasia), Ltd.—The second report of the above company, covering the six months ended December 31st, was published in March in the *Sydney Morning Herald*. Satisfactory trading is reported, although certain departments have been much disturbed since the commencement of the war. The ships' message traffic, owing to censorship, naval restrictions, and the use of some of the subsidised ships for Imperial purposes, has been reduced to a low ebb. The subsidy ships have slightly increased, and now stand at 80 passenger and cargo steamers. New business is periodically coming along. Since the outbreak of war over 70 men have been sent away to carry out naval and military work of various descriptions on the battlefields of Europe and Egypt, as well as on transports and special-service Government vessels. The net profit for the six months was £7,812, which, with £16 brought forward, makes £7,828 available. The directors recommend an interim dividend of 2½ per cent., absorbing £3,500, leaving £4,312 to be carried forward. Comparison of the six months with the 12 months ended June 30th, 1914, may be made thus:—

	Year ended June 30th, 1914.	Half-year ended Dec. 31st, 1914.
Net profit	£8,616	£7,812
Dividend per cent.	4	5†
Amount of dividend	5,600	3,500
Patent reserves...	3,000	—
Carried forward	16	4,312
Liabilities—		
Capital paid up	£140,000	140,000
*Reserves	3,793	8,248

* Reserves include depreciation, June 30th, £3,129; December 31st, £4,319. † Per annum.

Penarth Electric Lighting Co., Ltd.—The annual meeting was held at Electrical Federation Offices, W.C., on Monday. The report submitted showed that the capital expenditure at December, 1914, stood at £44,557. The total revenue for the year was £5,439, and the working expenses were £2,402. After paying interest on loans and on debenture stock, £750 is placed to renewals fund, £250 to reserve, 1 per cent. is to be paid on the ordinary shares, and £283 carried forward. Equivalent of 8-c.p. lamps:—

	Lighting.	Power.	Total.
1913	28,226	3,740	31,966
1914	31,231	4,487	35,718

The number of consumers increased from 529 to 606. Mr. W. L. Madgen has resigned his seat on the board.

Anchor Cable Co., Ltd.—The directors report that the profit for 1914 amounted to £31,778, plus £15,850 brought forward. It is proposed to pay a dividend of 16 per cent., carrying forward £32,129.

Shawinigan Water and Power Co.—The *Financial Times* quotes an American paper to the effect that early in June this company will issue a new block of stock, the proceeds to be used to reimburse the treasury for additions made in the last year or so, and for additional working capital.

W. T. Glover & Co., Ltd.—A petition has been presented and will be heard before Mr. Justice Neville on May 21st, asking for alteration of the articles of association by adding various powers relating to the acquisition, holding and working of lead, copper, and coal mines, the smelting and working of ores, the production, refinement and treating of lead copper, &c., and many other matters.

West Coast of America Telegraph Co., Ltd.

Sir J. Denison Pender, K.C.M.G., presided on May 11th over the annual meeting held at Electra House, E.C. He said that the revenue for the year had amounted to £61,129, an increase of £7,483. The working expenses, compared with those for 1913, showed a decrease of £4,532. Ship repairs to cables, a most important part of their expenses, were lower by £2,686, but, as he had so often pointed out, that was an item which at any time might be a heavy one. The future could not be foreseen, and all they hoped was that the repairs would be light, thus benefiting the expenses account. The cable had to be manufactured in England and sent out, so it was an expensive item, especially at the present time, and every repair, however small the fault might be, necessitated important expenditure on cable to rectify it. The duration of interruptions for 1914 was 112 days, against 97 days in the preceding year, and taking into account the state of things which existed in August and for some months afterwards, owing to the presence of German cruisers after the outbreak of war, that was very satisfactory, and it was due to a great extent to the vigilance of their staff on the coast that so little delay occurred in carrying out the repairs to their cables. A considerable part of the capital of the company was in stocks which matured at an early date, and therefore such provision must be made, if not to the full extent, as would enable the directors to deal with the financial position when the time came. That was the reason why they were unable to recommend any dividend on the ordinary capital this year; more especially as there was also a considerable depreciation in the value of the securities in the reserve fund. As they all knew, that depreciation was by no means confined to their company, but was universal, but it was all the heavier when the reserves were invested in gilt edge securities such as theirs' were.

Sir Albert J. Leppoc Cappel, K.C.I.E., seconded the motion, and the report was adopted.

Rhondda Tramways Co., Ltd.

Mr. L. B. Schlesinger presided, on May 6th, over the annual meeting, held at the offices, Lawrence Pountney Hill, E.C. In moving the adoption of the report, he said that the balance to the credit of the revenue account was £25,417. From this figure various items had to be deducted, including debenture interest, £11,470; sinking fund, £2,930; and rent to the Rhondda Council, which left a balance of £8,190; and that, together with the sum brought forward, gave them £8,783. After giving effect to the directors' recommendation to increase the reserve and renewals account by £2,000, bringing that account up to £16,000, there remained a balance of £6,783 to be carried forward. This sum was more than sufficient to pay the full year's preference dividend, but the directors did not recommend any distribution. Three causes had contributed to that decision. In the first place, there was the decreased receipts, amounting to £1,430; secondly, the anticipated increase in expenses due to the extra wages for employés and the increased cost of materials; and the third reason was the fact that the expenditure of £17,000 on the railless system had proved, for the first time, non-revenue producing. The railless system was approved by the Board of Trade and opened for traffic in December last, but the services had to be suspended in March owing to the state of the roads. The matter was receiving the attention of the road authority, who were asking the Local Government Board to sanction a loan for the purpose of reconstructing the roads. It had not been ascertained whether the application had been successful, but they anticipated that the necessary sanction would be obtained. An important factor was the want of travelling facilities in the colliery district, and this was a matter which might prove an inducement to sanctioning the loan. The company had obtained the consent of the Local Government Board to the issue of its remaining debentures. Until the outbreak of war, the undertaking had been quite satisfactory, and there had been an increase in the receipts of £2,014. But it had since decreased to £702. The company had been affected more so than other places. A large number of men, estimated at 17,000, had left Rhondda to join the Forces, and that had naturally affected the receipts. The passing of the dividend was a matter of great regret to the directors, but they felt, in view of the facts, that the shareholders would agree it was the wisest course. Turning to the accounts, the Chairman said the share capital remained the same as last year. The debenture capital now stood at £228,000, as against £231,000, a further £3,200 having been redeemed. A further £10,000 debentures had been issued. The reserves and renewals fund stood at £14,000, as compared with £10,000, and there had been added £2,000 recommended by the directors out of the year's profits. The special loan of £2,000 had been paid. The sundry creditors amounted to £7,107, as against £6,412. On the credit side, the capital account had been increased by a few pounds. The discount on the debentures was £15,000, as compared with £18,000. The extensions to date, including the railless trolley system, amounted to £16,645. With regard to the revenue account, the principle item was the traffic expenses, which were £13,530, compared with £12,632. The wages of conductors and other little items showed an increase. The net cost of the current was arrived at by deducting from the £12,462 the item of £2,000 for the credit side, which left £10,462, as compared with £10,325, a small increase. The repairs and maintenance had entailed an expenditure of £10,001, as against £7,488, an increase due to capital expended on the permanent way and mains. That item would always be a considerable one, owing to the heavy rainfalls and the mining character of the district. On the credit side, the revenue account showed an increase of £876 on the traffic receipts, of which £740 was attributable to the trolley system. In conclusion, the Chairman paid a warm tribute to Mr. Holliday, the new manager, who took up his duties last May.

The report, which was adopted, stated that there was no doubt that when the war was over the company could look forward to a return of prosperity owing to the continued development in the coal-mining industry.

	1912.	1913.	1914.
Gross revenue	£50,859	£65,241	£66,368
Traffic revenue—Tramways	£49,778	£63,721	£64,423
Railless	nil	nil	£174
Profit before providing for debenture interest, reserves and depreciations, etc.	£18,680	£27,686	£25,418
Passengers carried	9,035,974	11,660,230	11,999,667
Car miles run	1,093,584	1,311,408	1,413,638
Average receipts per car mile ...	10.92d.	11.66d.	10.97d.
Average receipts per passenger ...	1.32d.	1.31d.	1.29d.
Percentage of operating costs to traffic revenue	64.67	58.94	63.39
Percentage of operating costs to total revenue	63.26	57.56	61.70

The annual meeting of the Rhondda Tramways Electric Supply Co., Ltd., followed, Mr. L. B. Schlesinger again presiding. The proceedings were purely formal. The report, which was adopted, stated that, under an agreement dated August 6th, 1907, the Rhondda Tramways Co., Ltd., agreed to take from the company all current for the working of the tramways during the period of the lease—namely, 42 years—in consideration of which the Tramways Co. has the control and management of the undertaking, and is responsible for all working expenses, debenture interest and premiums on the sinking fund policies for the redemption of the debentures. The Rhondda Tramways Co., Ltd., is entitled to all profits made, and, in accordance with this arrangement, the profit of £2,000 to the credit of the revenue account has been transferred to the Tramways Co.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The annual meeting was held on May 11th, at Electra House, E.C., Sir J. Wolfe Barry, K.C.B., presiding.

The Chairman, in proposing the adoption of the report, said that the gross receipts amounted to £819,000, against £738,000 for 1913, showing an increase of £81,000. This satisfactory result was partly due to their having had to transmit the whole of the Australasian traffic for nearly two months, when the Government Pacific cable system was interrupted by the attack made upon the Fanning station by the German cruiser *Nurnberg*, on September 7th last. The working and other expenses amounted in round numbers to £379,000, against £365,000 in 1913, showing an increase of £14,000. The net profit for the past year was, roundly, £411,000, and, including £30,000 brought forward, there remained an available balance of a little over £441,000. The usual quarterly interim dividends of 2s. 6d. per share each had already been paid for the past year, and it was now proposed to distribute a like amount, making a total dividend of 5 per cent. for 1914. It was also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution to the shareholders, free of income tax, of 7 per cent. for the past year, and to carry forward £31,000, against £30,000 for 1913. After making the usual additions to the maintenance, ships', insurance, and depreciation funds, £200,000 had been transferred from the revenue balance to the general reserve fund. On the other hand, the fund had been debited during the past year with £273,000—for the balance of cost of the Penang-Singapore-Hongkong cables £194,000, for partial cable renewals £35,000, for loss incurred on the sale of investments during the year £44,000. Those operations depleted the general reserve fund by £73,000, and left it at the end of the year at £656,000. When he last addressed the shareholders he indicated that the loss created by the sale of investments during the past year would be deducted from the provision shown in the balance sheet of £200,000 for investment fluctuations, but, seeing that the war had very materially affected the value of all classes of investments, the directors had considered it to be a wiser policy to charge the whole loss against the general reserve fund, and leave the £200,000 intact. The reserve fund investments had been carefully re-valued on the basis of the official prices quoted at the end of last year and on March 31st last, from which it was found that the provision already made was sufficient to cover the existing depreciation. With regard generally to the changed conditions brought about by the war, the shareholders would readily understand that with their extensive cable system, and their repairing steamers having to move about in waters more or less frequented by hostile vessels, the directors and the staff had necessarily had an anxious and somewhat difficult time since the conflict began. Their chief duty and endeavour had naturally been to efficiently maintain telegraphic communication, and although they had had a good deal of repairing work to carry out from time to time, they had, so far, been fortunate enough to be able to carry on the traffic without a single interruption of any

importance. This, of course, was mainly due to the associated companies having so many different cable routes to the chief centres of commerce, and possessing a large fleet of cable steamers and other repairing facilities. The shareholders would not, however, be surprised to learn that considerable dislocation in the traffic arrangements had been caused by the war, especially in the early days before the altered conditions were fully established and provided for, but the directors had done everything in their power to meet the requirements and minimise the inconvenience caused to the telegraphing public by the new situation, while, at the same time, fulfilling their duties to the State. They were doubtless aware that under the landing licences controlling the relations between the cable companies and the governments concerned, governments, in time of war, had the right to take possession of the companies' offices and control the traffic. This right was exercised by the British Government on Sunday, August 2nd last, and, on the following day, the transmission of all public code and cipher telegrams was suspended, and the public were only allowed to send their telegrams in plain French or English language at full rates. Seeing that Government telegrams were entitled to precedence over all the companies' cables, and keeping open the lines of communication for the transmission of this class of traffic was a matter of the first importance, it was decided to suspend the transmission of deferred and week-end telegrams to enable them to provide as efficient a commercial service as was possible under the altered circumstances. Nevertheless, considerable delay resulted in the transmission of public telegrams, and the telegraphing public complained of the inconvenience, and also of the additional expense which they were consequently incurring. For some years past the associated companies had been in favour of charging for plain language telegrams exchanged with extra-European countries by grouping the letters so as to count ten to each word, but, although at one time they hoped to be able to carry this innovation, at the last Telegraphic Conference held at Lisbon, the proposal was not officially sanctioned. With a view, however, to assist in meeting the war requirements, it was thought that an arrangement of this kind might be introduced, and thus relieve the public from having to pay full rates for plain language messages, and, after entering upon negotiations on the subject, the ten-letter system of counting was introduced on September 23rd. Some of the Colonial Governments, however, found objections to the arrangement, and, after the system had been in operation for a few weeks and was giving satisfaction to the telegraphing public, it was withdrawn, while, as an alternative, coding was again allowed to be introduced with certain limitations. On October 1st the Eastern and Eastern Extension Companies found themselves in the position of being able to resume the transmission of deferred messages. The financial result to the telegraphing public of the ten-letter counting, while it lasted, was that they were charged about one-half of the ordinary rates, or about the same as for deferred telegrams, and the associated companies had done everything in their power to quicken the transmission of the deferred telegrams, in order that the public might have a good and trustworthy service on these favourable terms. The companies were unable, as yet, to resume the acceptance of week-end telegrams, owing to the necessity of keeping the lines free to meet eventualities, but the telegraphing public might rest assured that, as soon as it was possible—with due regard to the prompt transmission of Government and ordinary commercial telegrams—week-end telegrams would again be accepted for transmission over Eastern cables. Having regard to the heavy traffic which they had at times to transmit, it was very fortunate that the new cables laid by the Eastern and Eastern Extension Companies between Suez and Hong-Kong, *via* Colombo, were completed and opened for traffic before the outbreak of war. The shareholders would be interested to learn that they arranged some time ago for the free transmission over their lines of messages sent by Government departments relating to the killed and wounded amongst the British Empire Forces, and also for the acceptance at quarter rates of telegrams exchanged between soldiers, sailors, or nurses of the Expeditionary Forces and their relatives in different parts of the world. As the shareholders were aware from the graphic accounts given in the newspapers at the time of the occurrence, the company's Cocos station suffered considerable damage from the attack made upon it, on November 9th last, by the notorious German cruiser *Emden*. Knowing that hostile vessels were actively at work in the Far Eastern waters, they had taken the precaution soon after the outbreak of war to prepare the staff for all contingencies. Consequently, when the *Emden* suddenly appeared off the islands in the early morning of November 9th, the staff were on the alert, and, before the landing party could reach the station, they had communicated by cable with the naval authorities as arranged, and also sent out wireless signals in the hope that they would be picked up by one of the British warships believed to be in the neighbourhood. Fortunately, the Australian Contingent, with its convoys, was passing not far off the station at the time and, picking up the signals, the naval officer in charge at once dispatched the Australian cruiser *Sydney* with all speed to engage the enemy. The result was that the *Emden* was attacked before the landing force was able to finish its work of destruction, and, after severe fighting, the *Emden* was driven ashore in a hopeless condition. They would be gratified to learn that the staff's action on this occasion was much appreciated by His Majesty's Government. The Admiralty presented handsome gold watches, suitably inscribed, to the superintendent who was responsible for sending out the wireless signals, and to the company's doctor, who helped to succour the *Emden's* wounded. Appreciative letters had also been received from the Colonial Office and from the Committee of Lloyd's complimenting the staff on their action. The directors lost no time in conveying to the staff at Cocos the board's appreciation of their services, together with the marks of approval of the Admiralty, Colonial Office, and Lloyd's Committee. The shareholders would be pleased to learn that although the landing party entirely destroyed the instrument room, with its working apparatus, by axes, the Cocos station was able, thanks to the arrangements previously organised and the efficiency and energy of the staff under their trying ordeal, to resume working within 24 hours of the *Emden's* raid. This raid might easily have been attended with serious loss of life, but he was thankful to be able to say that no personal injury was inflicted on the Cocos staff. Unhappily, a very different state of things resulted from the deplorable mutiny that broke out at Singapore in February last, when, among the killed and wounded, three valued members of their staff, together with the wife of one of them, were murdered, and two others seriously wounded. The directors had expressed their sympathy and appreciation of the services of the Singapore staff, and he was sure that it would be endorsed by the meeting. Before concluding, he wished to record his appreciation of the patriotic devotion and the high sense of duty shown by the staff on shore and afloat in all parts of their system, and also at the head office, during a time of such great anxiety to them all. The ships' staff had done valuable work in maintaining communication, sometimes under trying and risky conditions; and the shore staff had dealt with the traffic as expeditiously as possible under the conditions of censorship imposed by the Government. They had been working long hours on week-days, Sundays, and holidays, and all, both on board ship and on shore, had cheerfully given up their periodical furlough in order to meet the demands of their country. It being impossible to speedily replace their highly trained and technical staff, the authorities did not desire them to enlist, and, although many of them would have liked to take some active part in the war, they had, with some few exceptions, accepted the ruling of the Army Council, who expressed the view that, having regard to their special qualifications, they were better serving their country by remaining at their posts than by joining the fighting forces. As many, however, as could be safely spared were allowed to enlist, and their places were not only being kept open for them, but they were at present being granted full pay. It would also interest them to know that two of the directors, the Hon. George Peel and the Hon. Arthur Brodrick, had been serving with His Majesty's Forces since the outbreak of war.

Sir JOHN DENISON PENDER, K.C.M.G., seconded the motion, and the report was adopted.

Barcelona Traction, Light and Power Co., Ltd.

A meeting of the holders of the 5 per cent. bonds of the above company was held on Wednesday, at the Cannon Street Hotel, for the purpose of considering a series of resolutions to alter the trust deed in certain particulars in order to raise funds to carry out the uncompleted work of the undertaking.

Mr. W. E. RUNDLE, general manager of the National Trust Co. of Canada, who occupied the chair, said that among the passengers carried to their death by the sinking of the *Lusitania* was Dr. F. S. Pearson, the President of the Barcelona Traction Co. Dr. Pearson had been over to America, where he had succeeded in placing a large amount of the prior lien bonds which it was proposed to issue, and he was coming over to England expressly for the purpose of attending the meeting. His loss was deeply regretted by all who had been brought into contact with him, either in personal or business relations. Proceeding to deal with the business of the meeting, the Chairman said his company occupied an entirely independent position in the matter. They were not financially interested in the Barcelona Co., but, as trustees for the bondholders, they were very much interested in anything that was done that might affect their security or their interests. The committee which had been at work for some time had prepared a report, copies of which had been circulated, and after a careful and exhaustive study of the proposals made by the committee he had no hesitation in recommending their acceptance to the bondholders. The report of the committee was largely based on the report of Dr. Parshall, who emphasised the fact that the company's undertaking was in an uncompleted state and that it was of paramount importance that the enterprise should be carried through to completion.

Dr. PARSHALL then formally moved a series of resolutions to give effect to the report of the committee.

Replying to a bondholder, Mr. E. R. PEACOCK, a member of the committee, said that it had not been found possible at the present, at all events, to locate the company in England. One of the reasons which weighed very heavily with them in coming to that decision was the fact that of the £8,000,000 of bonds outstanding, more than half were held on the Continent, and a further very substantial amount was held in Canada. Those bondholders would naturally not be prepared to support a scheme which would locate the company in England, and so make its earnings subject to the present heavy income tax.

The resolutions were carried unanimously.

General Electric Co., U.S.A.—The report for 1914 shows gross income of $90,467,692, against $106,477,439 for 1913. Costs, which include expenses of development, manufacturing, selling, administration and patents, and also depreciation in factory and plants, amounted to $81,496,728, against $96,207,834. Profit from sales amounted to $8,970,963, against $10,269,605. Total income was $11,855,383, against $14,065,789. Net profit amounted to $11,287,827, which is equal to 11·12 per cent. earned on $101,485,700 capital, as against $13,489,357, which is equal to 13·2 per cent. earned on $101,381,200 in 1913. Surplus, after dividends had been paid, was $3,145,000, as against $5,340,153. The directors state that, while there was a decrease of about 25 per cent. in the value of orders received, the total number of transactions was practically that of the previous year. The unfavourable relation between the number of orders and their value, characteristic of periods of depression, has operated to increase materially the cost of securing and handling business.—*Financial Times.*

Stock Exchange Notice.—The Committee has been asked to allow the following securities to be quoted in the Official List:—

Calcutta Electric Supply Corporation, Ltd.—Further issue of 6,220 ordinary shares of £5 each, fully paid, and 3,780 ordinary shares of £5 each, £4 paid (within Nos. 250,001 to 260,000); and 6,308 5 per cent. cum. pref. shares of £5 each, fully paid, and 3,692 5 per cent. cum. pref. shares of £5 each, £1 paid (within Nos. 200,001 to 210,000).

Gell Telegraphic Appliances Syndicate, Ltd.—Mr. Justice Astbury, in the Chancery Division on Tuesday (May 11th), on the petition of Gell Telegraphic Appliances Syndicate, Ltd., confirmed the reduction of capital of the company by cancelling 10s. of the £1 shares. Counsel for the company said the capital was £40,000, of which £37,700 was issued. That would be reduced by £18,850, the amount of capital lost. The object of the company was to acquire certain patents for a machine in connection with sending telegraphic messages, and a great deal of money was spent in experimental work. Further patents had been taken out. There was evidence of the loss.

STOCKS AND SHARES.

TUESDAY EVENING.

EVERY class of the community has been deeply stirred by the unspeakable infamies perpetrated so rapidly one on top of the other by the enemy within the short space of one week. The Stock Exchange, of course, has shared to the full the horror which thrilled the civilised world at the latest revelations of German barbarity. In Capel Court, business came to something like a standstill. Stock Exchange men clamoured for immediate action to be taken by their Committee, for turning out of the markets those members who, although naturalised, have Germany or Austria as their fatherland; and the Committee, genuinely alarmed for the bodily safety of those naturalised members, sent them a strong warning not to enter the markets at present.

A slight demonstration, unduly magnified by most of the newspapers, occurred on Saturday morning, when, for the first time since the war started, the Stock Exchange partially lost its mental equilibrium and became a shade hysterical in its burning indignation at the murder launched at the *Lusitania*. The last few business days have been completely overcast by the shadow of this tragedy; the immediate effect upon prices was comparatively small, but the springs of investment and speculation have been frozen, and business marched to a halt.

Prices gave way not from any selling that took place, but by reason of the numbness produced by the all-prevailing cause. Markets are, in a sense, asphyxiated by the poisonous gas of such wanton wickedness. A few quotations are a little lower, but Telegraph issues as a whole are firm, and, amongst industrials, improvements have occurred in Edison & Swan fully-paid shares and in General Electric Preference.

In calculating the yields derivable at the present time from certain Telegraph and other stocks, the dividends on which are paid free of income-tax, we have hitherto based the returns upon the dividends as though they were paid in the ordinary way—that is, less tax. To do this, however, seems scarcely fair; and, accordingly, we have amended our list in such cases as those where companies distribute their dividends free of tax. To put the matter clearly: it is obvious that a dividend of 8 per cent. less 2s. 6d. in the £ for income-tax, really amounts to a net return of 7 per cent. to the shareholder, and therefore 7 per cent. free of tax is precisely equal to 8 per cent. less the deduction. It will be noticed that the yields on Eastern Extensions, Eastern Telegraph Ordinary, Globe and Western Telegraphs are enhanced in no small degree by this recalculation, which we have made simply in order to bring the comparative figures into their correct perspective when viewed alongside other securities. Our method of working the sum is to take the yield in the ordinary way, and then to multiply it by eight and divide by seven, because the income-tax is now 12½ per cent.—2s. 6d. in the £.

There is a steady demand for the Eastern Telegraph group, and Western Ordinary have improved to 13¾. Last week's substantial rises in Great Northerns and Indo-Europeans have been well held, but the Anglo-American issues are slightly lower in sympathy with the prevailing sentiment elsewhere, which affected acutely the market in railroad shares in New York, although its effects were shorter-lived than those in the London market. One or two of the South American Telephone shares were a little easier; and Marconis slipped back to 33s. 9d., Canadians being 5s. 3d. and Americans 10s. 3d. The American Company has just issued its report, in which it is stated that the company's ship and shore equipments are 20 times greater than those of three years ago. No dividend is paid, but a surplus of $150,000 is carried forward. The Eastern Telegraph report shows good progress, and the net profit of £752,000 (after all deductions) is £73,000 higher than that of a year ago. The West African Telegraph is paying 4 per cent. for the year. There is little or no market in the company's shares. West Coast of America shares are supposed to be somewhere about 5s., as against 20s. when war broke out. The board have decided not to pay a dividend, because of the necessity for making a provision of £10,000 against depreciation in investments. The 4 per cent. Debentures, guaranteed by the Western Telegraph Company, stand about 93.

The Home Rail market shows an amount of firmness rather surprising in the circumstances. There are buyers about of Central London stocks, and the Underground group as a whole is very steady. Income bonds fell a point, and in this case also it will be noticed that we have corrected the yield in the same way as indicated above, because the interest on these bonds is paid free of tax. The Bill which has been prepared for authorising closer working agreement between the City and South London, the District, Central London, London Electric and London General Omnibus Companies, is being discussed with languid interest, and is expected to meet with a certain amount of opposition.

Mexico issues, as a whole, are better, and a rise of 10 points carried Mexico Trams to 40, the Company's 6 per cent. bonds at 37 being 2 points up. Mexican Light and Power shares are steady, but the First Bonds are a point higher at 51, and the prevailing impression appears to be that the worst of the Mexican trouble has been surmounted, with the future showing at least a gleam of possibility that matters may yet straighten out. The same subdued optimism has been felt so frequently on former occasions that its revival leaves one rather cold, although we suppose that in the mere nature of things the day will dawn when Mexico is once more at peace, and her people free to pursue commerce and industry. Meanwhile, the attempt made upon the life of the present provisional President of the Republic, Senor Roque Gonzales Garza, has not looked as though the revolution had been settled, and an all-round decline in Mexican Railway stocks shows how the outlook is regarded in other quarters.

Brazil Tractions have gone back a little to 55, though the Rio exchange keeps pretty steady at 12⅛d. There is little doing in the shares at the moment. Anglo-Argentine Tramways 5 per cent. Debenture stock has hardened to 90½, at which the yield of £5 10s. 6d. per cent. still looks tempting. Calcutta Electric Supply Ordinary shares improved to 6¾ on the issue of the report this week, showing an increased profit for the year of £13,500. The final dividend of 5½ per cent. makes 9 per cent. for the year, the same as for 1913; and the carry-forward of £11,500 is £4,000 better than it was 12 months ago. Calcutta Tramways stand at 6½, but they are *ex* dividend, whereas the Supply shares are cum. 5s. 6d. per share.

In the Industrial market, Edison & Swan fully-paid shares have recovered to 2, a rise of 5s., and this is the principal alteration on the week. Callender's are firm at 12, on the issue of the report, which states that all the departments of the company's factory were profitably engaged to their utmost capacity up to the end of last July, but on the declaration of war much of the business in hand was stopped. Reorganisation of the factory to meet altered conditions of trade has resulted in some of the departments now being busy, while others are well occupied. The Admiralty and War Office placed special orders with the company shortly after the outbreak of hostilities. The directors state that the war has for the moment caused a suspension of all telephone extensions, but that this work will without doubt be resumed when the war has ceased. Rubber shares are quiet, with a dullish tendency in some of the leading issues, and not much business in progress. Nor is there any further activity amongst armament shares, prices keeping just steady.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Blackpool-Fleetw'd	May 1	1,929	−1,227	17	6,073	− 1,109	8	..
Bristol	April 30	88,472	+1,719	17	148,236	+12,999	30·5	..
Chatham and Dist.	May 6	4,450	+ 485	18	18,371	+ 2,674	14·92	..
Cork	April 29	2,001	− 93	17	7,655	− 315	54·25	..
Dublin	„ 30	25,754	+2,071	17	98,353	+ 6,521	9·89	..
Hastings	„ 29	3,793	− 729	..	..	− 687	19·3	..
Lancashire United	May 5	6,467	− 918	18	28,189	− 554	42	..
Llandudno-Col. Bay	April 30	1,491	+ 155	21	4,645	+ 703	6·5	..
Tyneside	„ 21	2,264	− 190	16	8,231	− 110	11	..
Anglo-Argentine ..	„ 29	205,627	−13,213	17	867,396	−92,482	..	..
Auckland	„ 9	20,216	−1,486	40	207,151	+ 3,027	25·42	1·16
Calcutta	May 1	16,534	−1,064	..	..	− 5,112	..	..
Kalgoorlie, W.A. ..	Feb.	2,852	..	8	4,724	..	..	..
*Madras	April 30	1,024	+ 5	17	15,204	− 331	..	..
Montevideo ..	April	26,786	−2,864	26	174,655	−25,526	..	..
Dublin-Lucan Rly.	April 30	627	+ 12	17	2,184	+ 52	7	..

* Two weeks.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	May 11, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	8½	—	£6 1 3
do. 7 per cent. Pref.	7	7¾	—	4 10 4
Charing Cross Ordinary	5	4½	—	5 11 1
do. do. do. 4½ Pref.	4½	4¾	—	5 9 1
do. do. City Pref.	4½	4	—	5 12 6
do. 4 Deb.	4	90	—	4 9 0
Chelsea	5	4⅝	—	5 8 1
do. 4½ Deb.	4½	92	—	4 17 10
City of London	9	14½	— ½	6 6 4
do. do. 6 per cent. Pref.	6	12½	—	4 18 0
do. do. 5 Deb.	5	113	—	4 9 3
do. do. 4½ Deb.	4½	98	—	4 11 10
County of London	7	11½	—	6 1 9
do. do. 6 per cent. Pref.	6	11⅝	—	5 3 6
do. do. 1st Deb.	4½	100	—	4 10 0
do. do. 2nd Deb.	4½	95 xd	—	4 14 9
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅝	—	6 18 0
do. do. 6 per cent. Pref.	6	5	—	6 0 0
do. do. 4 Deb.	4	87	—	4 12 0
Metropolitan	8½	8½	—	5 12 5
do. 4½ per cent. Pref.	4½	4	—	5 12 6
do. 4½ Deb.	4½	94	—	4 15 9
do. 3½ Deb.	3½	75	—	4 13 4
St. James' and Pall Mall	10	8	—	6 5 0
do. do. do. 7 per cent. Pref.	7	6⅞	—	5 9 10
do. do. do. 3½ Deb.	3½	75	— 5	4 13 4
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1½	—	6 4 5
Westminster Ordinary	9	7½	—	6 0 0
do. 4½ Pref.	4½	4⅛	—	4 12 4
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	106½ xd	—	5 12 8
do. Def.	1½	22⅜	— ⅛	6 12 10
Chile Telephone	8	6⅞	— ⅛	5 18 5
Cuba Sub. Ord.	5½	8¾	—	6 5 9
do. Pref.	10	16	—	6 5 0
Eastern Extension	7	13⅝	+ ⅜	*5 17 5
do. 4 Deb.	4	92	—	4 7 0
Eastern Tel. Ord.	7	136	—	*5 17 9
do. 8½ Pref.	8½	74	—	4 14 7
do. 4 Deb.	4	93	—	4 7 0
Globe Tel. and T. Ord.	6	11½	—	*6 2 0
do. Pref.	6	12	—	5 0 0
Gt. Northern Tel.	22	33	—	6 17 6
Indo-European	65/-	56	—	5 16 1
Marconi	20	1⅞	—	11 17 0
New York Tel. 4½	4½	98 xd	—	4 11 6
Oriental Telephone Ord.	10	9	—	5 0 0
do. Pref.	6	1⅜	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 8
United R. Plate Tel.	8	6⅜	— ⅛	6 3 1
do. Pref.	5	5	—	5 0 9
West India and Pan.	1	1⅛	—	3 16 2
Western Telegraph	7	13⅜	+ ⅛	*5 16 5
do. 4 Deb.	4	91	—1⅛	4 6 6
Home Rails.				
Central London, Ord. Assented	4	7⅛	+ ⅛	5 2 0
Metropolitan	1½	29½	—	4 4 9
do. District	Nil	17	—	Nil
Underground Electric Ordinary	Nil	1⅛	—	Nil
do. do. "A"	Nil	5/6	—	Nil
do. do. Income	6	80	—	*8 11 6
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	4⅞	—	6 4 0
do. 2nd Pref.	5½	8¼	—	7 2 0
do. 4 Deb.	4	88	—	4 16 5
do. 4½ Deb.	4½	83	—1	5 2 3
do. 5 Deb.	5	90½	+1	5 10 6
Brazil Tractions	6	55 xd	— ½	10 18 2
Bombay Electric Pref.	6	10⅝	—	5 16 10
do. 4½ Deb.	4½	91	—	4 19 0
Mexico Trams	Nil	40	+10	Nil
do. 5 per cent. Bonds	—	58	—	Nil
do. 6 per cent. Bonds	—	87	+2	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	42	—	Nil
do. 1st Bonds	—	51⅝	+1	—
Adelaide Sup. 6 per cent. Pref.	6	5½	—	5 14 8
do. 5 Deb.	5	103	—	4 17 1
Manufacturing Companies.				
Babcock & Wilcox	14	52/-	—	5 7 8
British Aluminium Ord.	5	20/6	—	4 17 7
do. Pref.	6	18/6	—	6 9 9
British Insulated Ord.	15	11½	—	6 10 5
do. Pref.	6	6½	—	5 0 0
British Westinghouse Pref.	7½	1⅛	—	7 15 0
do. 4 Deb.	4	73	—	5 11 1
do. 6 p. lien	6	99	—	6 1 8
Callenders	15	12	—	8 6 8
do. 5 Pref.	5	5	—	5 0 0
do. 4½ Deb.	4½	98	—	4 12 4
Castner-Kellner	15	8½	— 1/16	4 12 6
Edison & Swan, £3 pd.	Nil	13/8	—	Nil
do. do. fully paid	Nil	2	+ ½	Nil
do. do. 4 Deb.	4	63	—	6 7 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	5	13/6	—	7 5 6
do. do. Pref.	7	1	—	7 0 6
Gen. Elec. Pref.	6	10⅜	+ 1/16	5 17 8
Henleys	20	14½	—	*7 17 8
do. 4½ Pref.	4½	4¼	—	4 12 4
do. 4½ Deb.	4½	97	—	4 12 9
India-Rubber	5	9½	—	5 9 7
Telegraph Con.	20	87⅛	—	5 8 6

* Allowance made for dividends being paid free of income-tax.

Wellingborough Electric Supply Co., Ltd.—The annual meeting was held on Monday at Electrical Federation Offices, W.C.—The report showed that the total capital expenditure at December, 1914, was £32,522. The total revenue was £3,493, and the working expenses £2,475, leaving £1,018. After providing £141 for interest on loans, and £334 for debenture interest, there is a surplus of £543, which reduces the balance at the debit of net revenue account to £567. The units sold were 358,459, as compared with 340,581 in 1913.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 12th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric per cwt.	4/6	..
a ,, Nitric per ,,	19/-	..
a ,, Oxalic per lb.	..	..
a ,, Sulphuric per cwt.	..	..
a Ammoniac Sal ,,	£49	..
a Ammonia, Muriate (large crystal) per ton	£40	..
a Bleaching powder ,,	£9	..
Bisulphide of Carbon ,,	£21	..
a Borax ,,	£92	..
Copper Sulphate ,,	£29	..
Lead, Nitrate ,,	£35	..
a ,, White Sugar ,,	..	..
a ,, Peroxide ,,	..	..
c Methylated Spirit per gal.	..	..
a Potassium, Bichromate, in casks per lb.	7d.	..
a Potash, Caustic (88/90 %) per ton	..	..
a ,, Chlorate per lb.	1/6	..
a ,, Perchlorate ,,	1/6	..
a Potassium, Cyanide (98/100 %) ,, (for mining purposes only)	Nom.	..
a Shellac per cwt.	65/-	..
a Sulphate of Magnesia per ton	..	..
a Sulphur, Sublimed Flowers ,,	£11 10	..
a ,, Recovered ,,	£8	..
a ,, Lump ,,	£8 10	..
a Soda, Caustic (white 70/72 %) ,,	£10 2 6	..
a ,, Chlorate per lb.	10½d.	..
a ,, Crystals per ton	45/-	..
a Sodium Bichromate, casks per lb.	8¼d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots per ton	£90	..
b ,, Wire, in ton lots (1 to 14 S.W.G.) ,,	£120	..
b ,, Sheet, in ton lots ,,	£150	..
g Babbitt's metal ingots ,,	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	1/- to 1/0½	..
c ,, Tube (brazed) ,,	1/0½	..
c ,, ,, (solid drawn) ,,	1/0½ to 1/0⅝	..
c ,, Wire, basis ,,	1/0½ to 1/0⅝	..
Copper Tubes (solid drawn) ,,	1/1½ to 1/1¾	..
a ,, Bars (best selected) per ton	£100	..
a ,, Sheet ,,	£100	..
a ,, Rod ,,	£100	..
d ,, (Electrolytic) Bars ,,	£89	£3 inc.
d ,, ,, Sheets ,,	£107	£3 inc.
d ,, ,, Rods ,,	£95	£3 inc.
d ,, ,, H.C. Wire per lb.	11¼d.	¼d. inc.
f Ebonite Rod ,,	8/-	..
f ,, Sheet ,,	2/6	..
a German Silver Wire ,,	1,9	..
b Gutta-percha, fine ,,	6/10	..
b India-rubber, Para fine ,,	2/7	1d. inc.
l Iron Pig (Cleveland warrants) per ton	64/7	11d. dec.
l ,, Wire, galv. No. 8, P.O. qual. ,,	£20	..
g Lead, English Pig ,,	£21	..
m Manganin Wire No. 28 per lb.	..	..
g Mercury per bot.	£12	..
c Mica (in original cases) small per lb.	4d. to 2/6	..
e ,, ,, ,, medium ,,	8/- to 5/-	..
e ,, ,, ,, large ,,	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c. ,,	Nom.	..
p Phosphor Bronze, plain castings ,,	1/1 to 1/3½	..
p ,, ,, rolled bars & rods ,,	1/2 to 1/3½	..
p ,, ,, rolled strip & sheet ,,	1/3½ to 1/5½	..
o Platinum per oz.	185/-	..
d Silicium Bronze Wire per lb.	1/1	2½d. inc.
r Steel, Magnet, in bars per ton	£70	..
g Tin, Block (English) ,,	£163	..
n ,, Wire, Nos. 1 to 16 per lb.	2/8	..
p White Anti-friction Metals per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.) ,,	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Lewes and District Electric Supply Co., Ltd.—The capital expended during 1914 was £388, making the total £34,163. The revenue was £4,068, and the expenses were £2,410, leaving £1,659. To renewals fund £600 is placed, to reserve £200, 2 per cent. is paid on the ordinary shares, and £199 is to be carried forward. The demand for energy for lighting and power continues to increase satisfactorily. The number of installations connected has increased from 419 to 448. The units sold aggregated 279,048, as compared to 248,408 in 1913. The annual meeting was held at Electrical Federation Offices, W.C., on Monday.

Yorkshire (Woollen District) Tramways, Ltd.—The annual meeting was held at Electrical Federation Offices on Tuesday. The report, to which we referred briefly last week, showed that the capital expended during 1914 was £3,378, making the total £338,735. The passengers carried, with the same route mileage, cars and omnibuses, was 11,003,293 in 1913, and 11,532,764 in 1914. The proportion of expenses to receipts remained unaltered at 61 per cent.

THE POWER SUPPLY OF THE CENTRAL MINING-RAND MINES GROUP.

By J. H. RIDER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 15th*, 1915.)

(*Continued from page 672.*)

The most general form of depth indicator used on winders on the Rand is the dial pattern. The dials are usually about 5 ft. in diameter, and are mounted on high cast-iron pillars facing the driver's platform.

When the old steam winders were converted to electric driving the original depth indicators were kept in use, and the electrical instruments, being of a small size, had to be mounted on or close to the driver's platform so that they could readily be seen.

It appeared to the author that it was a wrong principle to make the driver have to watch two sets of indicators, one mechanical and one electrical, in such different positions and at such different distances, and that the eye strain must be detrimental. He therefore endeavoured to bring all the indicators to one place, at a distance of about 6 ft. in front of the driver, and decided to use a depth indicator of the dial pattern, of the type in which the pointer moves through a very wide angle, covering at least 1¼ turns, in a circular path of constantly and regularly increasing (or decreasing) radii. So far as he is aware this type was first designed and used by Mr. Roberts, of Knights Central, Ltd., Germiston.

The final arrangement is shown in fig. 6, from which it will be seen that the electrical instruments and the air pressure gauge for the brakes are mounted between the two dials. The indicator pointer is carried in a rectangular groove at the front end of the pointer spindle, and is guided in its circular motion by a small roller on the underside, which engages in a roller path formed in the depth of the dial face. A small screen is fixed at the outer end of the pointer, which covers up the markings on the inner ring when the pointer is indicating on the outer ring.

The dials are of only 27 in. diameter, and the end of each pointer can move through a total path of about 116 in. This, with only an 8-ft. diameter drum, will serve for a depth of 2,900 ft., on the basis of 1 in. of movement for each revolution of the drum.

The complete indicator set is mounted on two pillars immediately in front of the driver's platform, with the tops of the dials at a height of about 4 ft. above the platform level. The driver is thus able easily to see over the top, to watch the drum marks, ropes, etc., when necessary.

The driving spindles for the dials are connected by gearing to the drums in the usual way.

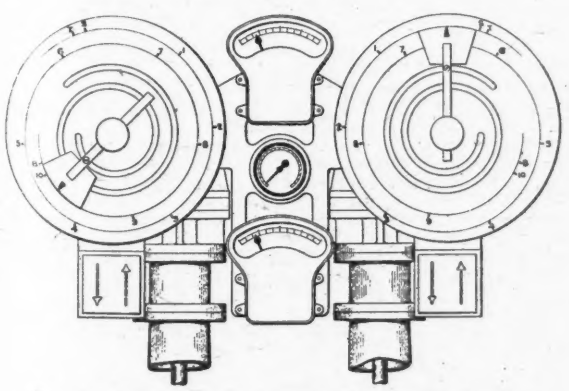


Fig. 6.—Combined Indicators for Electric Winders.

Immediately beneath each dial in fig. 6 will be noticed a small square box, with two arrows on the front side. Each box is divided into two vertical compartments, with an incandescent lamp inside each. The arrows are stencil cut through the cover, each right-hand arrow being covered by red glass and each left-hand arrow by green glass. A small control switch is connected to the operating lever, so that when the skip in the left-hand shaft compartment is being raised (and the skip in the right-hand compartment being lowered), the right-hand arrow (red) under the left-hand dial, and the left-hand arrow (green) under the right-hand dial are illuminated. The reverse action takes place when the skip in the right-hand shaft compartment is being raised. The driver has therefore an instant indication as to which skip is being raised, and follows the movements of that dial indicator pointer which has the red arrow under it.

Next to winding, the most important duty of the electric motor on a mine is probably that of underground pumping. Motor-driven geared ram pumps for heads up to between 2,000 and 3,000 ft. were the common practice until 1912, when, on the advice of the engineers of the group, it was decided to use high-speed, multi-stage centrifugal pumps, with direct-coupled motors, at the South Rand shaft of the Crown Mines, Ltd., and at No. 1 Shaft, Durban Roodepoort Deep, Ltd. Each plant consists at present of two pumping units, each of which comprises a high- and low-pressure 8-stage Sulzer pump, with the motor arranged between the two pumps, and lifts 375 gallons of water per minute to a height of 2,400 ft. The sets run at 1,470 r.p.m. and take about 500 b.h.p.

A little trouble was experienced at first owing to the nature of the water, which was slightly acid and contained a large amount of finely-powdered rock in suspension. A scheme of settling sumps was then arranged, in which the acidity of the water is removed by lime treatment and the suspended matter is allowed to settle. Since these sumps have been provided the plant has worked with great success, and is now being extended.

The importance of reliable underground mining pumps, and particularly of the electric supply to the motors of such pumps, cannot be over-estimated. A stoppage of less than 24 hours would be sufficient in some cases to flood the lower levels of the mines, which would not only drown out the pump chambers, but involve bailing in the shafts by means of tubs and the winding plant before the pump chambers could again be entered. For the lowest level of the South Rand Shaft of Crown Mines, Ltd., the pump motors will be operated at 200 volts from oil-immersed transformers, and the rotors will be of the squirrel-cage type. They will be started with the primary windings of the transformers connected in star, which will be changed over to mesh connection when full speed is reached. The object of this is to render the motors less liable to breakdown should the pump chamber become flooded. There will be no switches between the transformers and the motors.

The other classes of pumps used on the mines are generally electrically driven by belts. Nearly all the motors are of the slip-ring type, in which the rings are short-circuited and the brushes lifted at full speed. Belt driving has been found to have many advantages over direct coupling, as the pumps are often in positions, such as pits which are liable to be flooded, where a motor could not be placed, and, owing to the increases in the reduction plants from time to time, it is very convenient to be able to alter the speeds and lifts of the pumps merely by altering the sizes of the pulleys.

The stamp mill is a feature of all gold mines. The Californian type of stamp is in universal use; it consists of a circular steel weight, about 9 in. diameter, and 4 ft. long, fixed at the lower end of a steel rod called the "stem." The rod and its stamp are lifted by means of a cam, which, by rotating, engages on the underside of a tappet on the stem, lifts it for a distance of about 8 inches, and then allows the whole to fall by gravity on to a steel block at the bottom. Double-armed cams are employed, and the stamps are generally set in blocks of five or ten, and worked from a common cam shaft, the cams being arranged so that the stamps fall, one after the other, in a regular sequence. The ore is fed with water under the stamps, which weigh from 1,200 to 2,000 lb. each.

The cam shafts of the different stamp groups are driven by belts. Each stamp requires 5 h.p. on the average. The whole of the work is done by the motors in lifting the stamps, and is therefore the same whether any rock is being crushed or not.

The cams are double armed, and therefore the cam shafts revolve at only 49 r.p.m. This is a low speed and entails the use of a countershaft to enable a standard motor to be used. The largest pulley which is practicable on the cam shaft is of 7 ft. 2 in. diameter, and even with this the belt speed is only 1,100 ft. per minute. Very wide belts have to be used, with a jockey pulley to keep them tight, owing to the nearly vertical drive. Between the motor and the countershaft a belt speed of 2,630 ft. per minute is obtained.

Although the existing form of stamp mill is such a crude device and has apparently so many engineering defects, it has survived and will continue, because of its extreme simplicity and consequent reliability.

The modern practice is to crush to a moderate fineness only in the stamp mill and to complete the process in tube mills. By this means the output capacity of the plant is considerably increased and a much finer product is obtained.

A tube mill takes a considerable amount of energy to start it rotating, as the whole of the weight of the material lies at the bottom. It is also very sensitive to overloading, and many tube mill motors have been burnt out from this cause. Motors of 100 h.p. have been generally used, but these are gradually being replaced by motors of 125 h.p. and 150 h.p. for this reason.

A number of attempts have been made to drive tube mills by direct gearing from the motor shaft, but, so far as the Rand is concerned, with no great success. Motors running at 365 r.p.m. were used, with "Citroen" single-reduction gears, consisting of a pinion on the motor shaft and a spur rim bolted on the outside of the tube mill at one end. The gear ratio was about 13 to 1. The end movements of the tube mill were sufficient to do away with all the benefits of the high-class gears, and even with a flexible motor coupling caused great gear wears and trouble at the motors.

The present standard practice is to use a motor running at

585 R.P.M., to belt this to a pulley on a pinion shaft running at 120 R.P.M., and to use straight toothed gearing with a ratio of about 4.3 to 1. The mechanical efficiency may be slightly less, but the commercial efficiency is decidedly greater.

Four of the mines in the group do not obtain their supply of compressed air from the air mains of the power company, but use electrically-driven compressors on their own property.

The rope-driven compressors are all of the horizontal 2-stage type, and in each case have been converted from steam driving by removing the steam pistons and replacing the fly-wheel by a rope pulley, on to which the motor drives. The direct-coupled compressors are, with one exception, of Messrs. Belliss & Morcom's standard vertical 2-stage pattern.

Intercoolers are used between the different stages of all the compressors. The driving is by 3-phase constant-speed motors.

The Belliss compressors were purchased under efficiency guarantees, and it is interesting to note that their testing was the means of converting the makers from their practice of stating the output on calculations, to the more accurate method of actually measuring the output. The difference shown by the two methods, as the result of tests, was that the measured efficiencies were about 10 per cent. below those guaranteed. The volume of free air (at atmospheric pressure) delivered by reciprocating compressors is generally not more than 88.5 per cent. of the piston displacement, and is very often less. Calculations from indicator cards generally show from 99 to 95 per cent.

The power company bears the whole cost of operating the above compressor plants, including the electrical energy, and the mines pay for the air through meters in the ordinary way.

Small electrically-driven compressors, of capacities from 3 to 5 lb. of air per min., are used in conjunction with the brake gears of the electric winders, as stand-bys in the event of failure of the power company's air supply. They are hardly ever used.

Electric power is employed underground for hauling the broken ore from the stopes to the ore bins adjacent to the shafts, both by main and tail rope haulages and by electric locomotives. The former are operated by fixed 3-phase motors and the latter from overhead wires.

Main and tail and continuous rope haulages are used on the surface to convey the ore to the mills, the sands and waste rock to the dumps, etc. Belt conveyors are also frequently employed. The application of electric motors to these services presents no special features.

The only difficulty in using motors for driving crushers is caused by the great amount of fine dust which always accompanies dry crushing operations. Even though the motors are generally placed in separate houses, the dust manages to find its way through the necessary belt and shaft openings, and in time seriously chokes the ventilating passages of the motors and gets into the bearings.

The work of the crushers is very variable and intermittent, and the R.M.S. loading of the motors is very low, when a separate motor is used for each crusher. Notwithstanding this, it is better practice to use a separate motor for each crusher than one larger motor for several crushers, as it not infrequently happens that the maximum crusher loads occur at the same time. There are not enough crushers employed at the individual stations to give anything like a levelling-out of the load.

As a rule all motors of 50 H.P. and below are wound for 525 volts, and all motors above 50 H.P. for 2,100 volts. Those below 15 H.P. are of the squirrel-cage type, and those above of the slip-ring type.

The small squirrel-cage motors are started by switching the stator directly on to the mains. In the future it is intended to use motors with squirrel-cage rotors for much larger sizes, and these will be started by means of compensator transformers.

The slip-ring motors use a water tank with three dipping plates in the rotor circuit for starting purposes. The stator is switched directly on to the mains with the plates raised, and they are then gradually lowered until they are short-circuited at the tank. The rings are then short-circuited on the motor and the brushes raised. The usual short-circuiting arrangement is generally so defective that in many cases it has been removed, and the motor run with the brushes always down on the slip-rings.

In order to avoid a high pressure across the slip-rings on starting up, either a small (high value) resistance is connected between the dipping plates, or the level of the liquid is so arranged that the tips of the plates are always immersed.

Maximum-current and no-volt trip coils are used on the oil switches of all slip-ring motors, and of larger squirrel-cage motors which are started by compensators. For small squirrel-cage motors, which are self-starting when the stator is switched on, fuses only are used.

(To be continued.)

Discussion at Birmingham.

Mr. N. B. Rosher said the paper differed from most others, in that it admitted that there had been troubles and failures of the plant. The author was to be commended for having made these admissions; it was from records of failure and troubles experienced that frequently most was to be learned. Some rather astonishing particulars were given of bad design and workmanship in the plant installed. It would be interesting to know where the plant was made: he would be surprised to hear that it came from this country. When he was in Cape Colony some years ago a large proportion of the electrical apparatus was purchased from the United States on account of the exceedingly low freights by comparison with those quoted for goods from Europe. As regarded British products, he could not agree with the author that flimsiness of design was the usual characteristic of three-phase motor brush gear. Neither did he believe that it would be easy to find British-made motors in which the stator frames became distorted under load, or in which a 6-ft. rotor had a radial air gap of only 1 mm., a more usual figure being at least double that amount. With regard to the author's formula for minimum radial air-gap, it would appear that the figure obtained by this formula for the 6 ft. diameter rotor was cutting it rather fine. A rough approximation for the air gap, which he had found to agree very closely with the gap as measured on a large number of motors of various makes and sizes, was to take the gap as being 1/500 of the rotor diameter. This formula gave rather too large a gap for motors having rotors of such large diameters as the one in question. He would ask the author why the drills were not electrically operated, as was being done with success in this country, instead of by compressed air. The efficiency of a compressed-air system did not as a rule exceed 30 per cent., whereas the efficiency of the electric system might be taken at 80 per cent. Assuming that compressed air must be retained for blowing out the workings, would it not on the whole be more advantageous to install electrically-driven compressors at each mine?

Dr. C. C. Garrard said there was no doubt that for large power consumers the system of having three separate meters in series was a very good one. He asked whether each was provided with its own current and potential transformers. With regard to fig. 5, it appeared to him that this diagram had a very serious fault in that should the apparatus go wrong in any way, warning was not given, and an accident might happen. For example, a break in the battery connection would prevent the warning hooter sounding. Any such apparatus should be so constructed that in the event of its going wrong it gave the danger signal and prevented an accident. Mr. Rider took up the thorny subject of the alleged inability or unwillingness of manufacturers to supply what the customer wanted. He trusted Mr. Rider would not think he was referring to him when he said that in the majority of cases the manufacturer knew very much better what the customer should have than the customer did himself. This was only to be expected, as the manufacturer devoted his life to manufacturing, say, a particular article and knew everything about it from A to Z; whereas probably the purchaser had a superficial acquaintance with the article in question. The fine art of salesmanship, of course, was to conceal this fact and, while letting the customer believe he was getting what he asked for, to sell him what he should have. In this way future trouble was avoided which, if it did occur, the manufacturer was bound to get blamed for, whether it was his fault or not. The very fact that these disputes could occur showed the great need which existed for an increased standardisation of electrical apparatus. The state of manufacture of electrical oil switches was at the present time quite chaotic. Mr. Rider apparently had specified a rating of 800 amps. 15,000 volts for his 2,000-volt switches. This, however, was quite an arbitrary figure. The Verband Deutscher Elektrotechniker about a year ago laid down a rule that the rating of an oil switch must correspond to the maximum current which it would have to break on short circuit in the situation where it was used.* This was undoubtedly right.

Mr. F. Greenhalgh asked, with reference to the operation of oil-immersed stator switches or liquid controllers, if the plain butt-contact switches which had been used to such a large extent, had withstood arcing satisfactorily, and whether they required much more attention than the open type carbon-break switches illustrated in fig. 4. While the liquid controller gave a particularly smooth acceleration, serious objection appeared to be taken to the manual labour required to operate it. Had Mr. Rider had any experience with the type of liquid controller in which the dippers were lowered into the water by a float in a small chamber controlled by a gate valve, which could be adjusted to give any depth of immersion in somewhat the same manner as that adopted in the standard liquid winding controller? Several of these controllers were already employed on small mine hoists in this country, and they would appear to have largely overcome the objection referred to, as the volume of water to be handled was much smaller than in the other case.

Mr. J. M. Walshe said that in referring to the tests of the motor-driven air compressors the author gave figures showing a discrepancy of 10 per cent. between the maker's guarantee and the results of a test on site. The larger part of the difference he considered to be due to the method of estimating the output of air. The efficiency stated was so much lower than was usually obtained with this class of compressor that he doubted very much whether the method used was reliable on those particular tests.

Dr. M. L. Kahn said that in view of the unique experience of Mr. Rider with three-phase induction motors used for main and tail haulage gears, he was particularly interested in his remarks about this point. The three-phase winders were compared with winders controlled on the Ward Leonard system.

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* See Elec. Rev. January 2nd and 16th, 1914.—Eds.

The latter required for each winder an induction motor, a direct-current generator, and a direct-current motor. The last two machines introduced two large commutators into the working of the system. The haulage gears as installed in most mines on the Rand only employed slip-ring-type induction motors, which offered advantages in cost of installation and in maintenance, and reduced the possibility of trouble by decreasing the number of units required. In spite of this apparent simplicity, Mr. Rider seemed to favour the Ward Leonard system, apparently due to the fact that in the Ward Leonard system the whole speed control was effected by shunt regulation, while in the single-motor system, large weirs of liquid starters had to be moved by hand.

Dr. Kapp said a debt of gratitude was owed to Mr. Rider for having given so eminently practical a paper; but this feeling of satisfaction was overshadowed with a feeling of uneasiness when they read of the failures recorded, not unavoidable failures, but failures due to dishonest work. That any firm should send out faulty work patched up so as to hide the faults was bad enough, but that the work should be sent knowingly to a place where the lives of men depended on honest work was nothing short of scandalous. The author had not disclosed the makers' names! but he would be glad

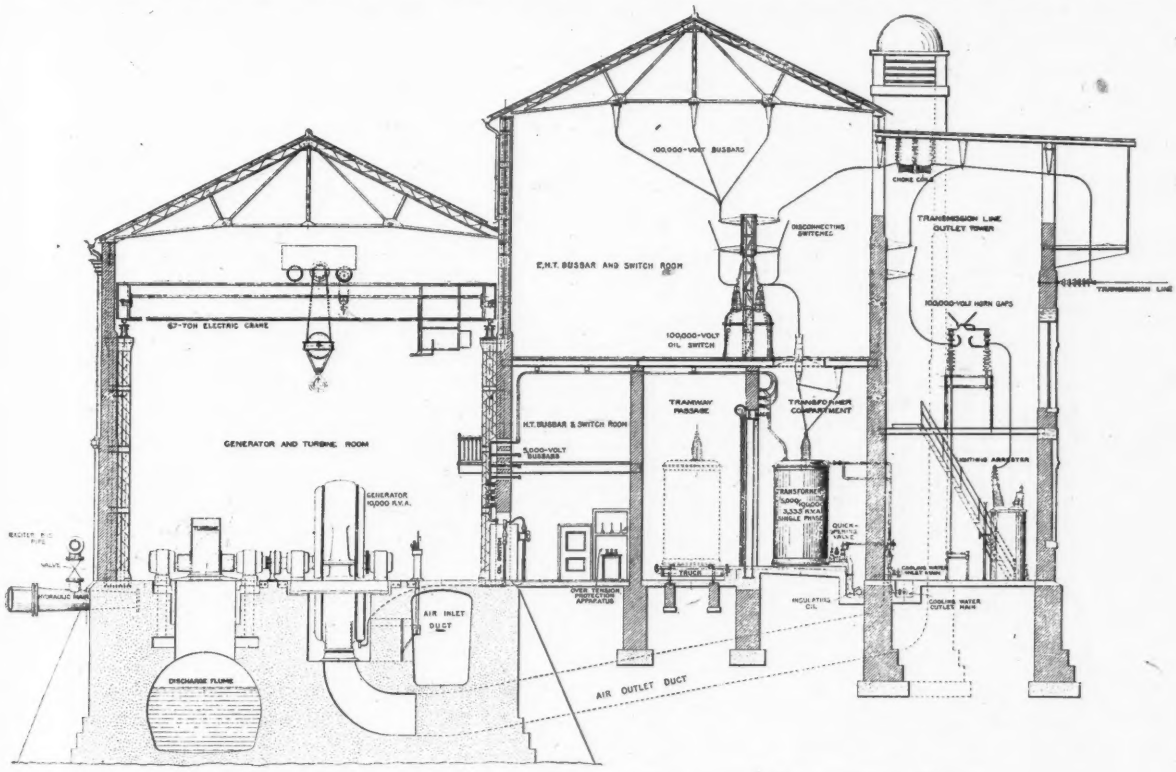


Fig. 24.—Bombay Hydro-electric Scheme: Sectional Elevation of Power House, Khopoli.

if the author in his reply gave an assurance that these particular examples of commercial dishonesty did not come out of British workshops. The author stated that a temperature rise of only 35° C. was allowed, making the absolute temperature, with an air temperature of 35° C., only 70°. This was considerably lower than the Engineering Standards Committee allowed, even for untreated cotton insulation. The air-gap in asynchronous motors by the author's formula was smaller than generally allowed. He suggested that it would be safer to allow a larger air-gap and counteract its worsening effect on the power factor by using phase advancers. This would also have the incidental advantage of reducing the great variation in voltage mentioned in the paper.

THE BOMBAY HYDRO-ELECTRIC SCHEME.

By ALFRED DICKINSON, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *April 29th*, 1915).

(*Concluded from page* 661.)

The present installation covers two transmission circuits on one line of towers. The conductors consist of 7-strand hard-drawn copper wire, the area of each wire being 0.095 sq. in.

For the creek-crossing spans a 7-strand hard-drawn silicium bronze conductor is used, having an area of 0.169 sq. in. The mechanical tests are a breaking stress of 14,000 lb., an elongation of 1¼ per cent. in 6 in. and an elastic limit of 10,500 lb. A torsional test of 8 twists in 6 in., and a wrapping test of six times round its own diameter unwrapped and re-wrapped.

For jointing up on the site a twisted-sleeve mechanical joint is used, which is made by passing the two ends of the conductors in opposite directions through a copper sleeve, then clamping the wires and sleeve together with two clamps and rotating the clamps in opposite directions until the joint is made in several complete twists.

The conductors are spaced 10 ft. 6 in. apart, and in the case of the intermediate towers are arranged delta fashion on either side of the tower, suspended on 6-unit insulators. In the case of the anchor towers the conductors are arranged vertically on either side of the tower and are suspended on 6-unit insulators. For the creek-crossing towers 7-unit insulators are used, the conductors being arranged vertically over one another on either side.

The suspension insulators (fig. 25), which are 10 in. in diameter, are of two types, viz., of the metal hooded type with ball joints for using vertically on intermediate towers, and of the link type for using horizontally on anchor towers. They are made from the best-grade non-absorbent porcelain, highly vitreous, of uniform hard glaze, dark grey in colour, with metal hoods of malleable cast iron and suspension links of galvanized mild steel, the threaded parts being sherardized and a special non-hygroscopic cement being used for cementing up the parts. The arrangement for attaching the suspension insulators consists of a sleeve in which the conductor is clamped, and for the anchor insulators a gripping sleeve through which the wire is passed and fastened with a split nut, all the parts being galvanized.

Each unit with fittings in place is subjected to a mechanical test of 1½ tons tensile stress for the suspension type, and 1⅔ tons for the strain type, the stress being applied for 10 seconds in a tension testing machine. The completed units are subjected to an electrical dry test of 60 kilovolts for 5 minutes and 70 kilovolts for one minute, the pressure being obtained from a transformer giving a 50-period sine-wave single-phase supply, and the insulators have to withstand such tests without flashing over or showing any defects.

The towers are of Siemens-Martin steel and are built in two sections, a superstructure and a base riveted to the former on site. Three types are used, viz., suspension, anchor, and special towers at creek crossings, about 500 in all being required. The design of all towers is based on a wind pressure of 25 lb. per square foot, the sag of the wires being regulated to give a factor of safety of 4 at this pressure and at a temperature of 50° F. The suspension towers are designed to withstand any two conductors breaking, and the anchor towers to withstand all the conductors breaking on one side. In addition to the stress due to wind, the anchor towers are designed for a change in direction of 30° from the straight, up to an angle of 150° between the circuits, in the vertical or horizontal direction.

Fig. 26 illustrates the three types of towers used. The ordinary towers are 62 ft. high from the ground, and are spaced

500 ft. apart. The creek-crossing towers are 160 ft. high from the top of the caissons, in order to comply with the Government requirement that no part of the transmission line shall be within 80 ft. of the water at high tide, and are spaced 1,185 ft. apart. Each creek-crossing tower is carried on four caissons, consisting of cast-iron cylinders, 6 ft. in diameter, filled with concrete.

One tower of each type was tested to destruction at the maker's works. Such tower was erected complete on the foundations, and was loaded gradually under the conditions for which it was designed. The external loading was applied by steel hawsers to represent the stress-diagram conditions. Under these tests the towers showed the required factor of safety of 4.

The telephone equipment consists of two circuits of No. 14 S.W.G. copper-clad wire having a conductivity of 45 per cent., a resistance of 17.38 ohms per mile, a breaking stress of 44

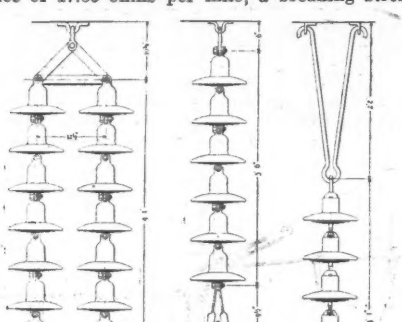


FIG. 25.—TRANSMISSION-LINE INSULATORS.

tons per square inch, and a weight of 103 lb. per mile. On the land portion of the line the telephone circuits are arranged below the power circuits, one on each side of the towers, and are carried on transposition pin-type insulators, intermediate telephone poles being placed midway between the towers; whilst where the transmission line crosses the creeks the telephone circuits are placed above the power circuits. The instruments consist of water-tight, high-tension, terminal telephones, which are installed at the power house, switch towers, and receiving station, and are mounted on marble panels with protective devices. A transformer is interposed between the speaking and ringing apparatus and the line, and hearing takes place through a rubber tube, which provides for safety in the event of the telephone lines becoming crossed with the power circuits.

For removing static disturbances in the telephone line in the event of a fault on a power circuit, a special type of drainage coil is used. Portable telephone sets are also provided.

A guard wire for protection against lightning is arranged over each power circuit, and consists of a 7-strand steel cable, 0.295 in. in diameter, 0.188 lb. per foot maximum weight, and 6,400 lb. minimum breaking strength for the land portion of the line, and 0.378 in. in diameter, 0.309 lb. per foot maximum weight, and 11,000 lb. minimum breaking strength for the creek crossings. These cables are double galvanized and are boiled in linseed oil.

The equipment at the change-over stations in the line consists of four triple-pole, single-throw, 100,000-volt, bolt-type, out-of-door, disconnecting, air-break switches, which are mounted on 7-unit insulators fixed on wooden supports on the towers and are operated by rods from the ground through bevel gears and rack.

Each of the present circuits will transmit a load of 15,000 KW. at 0.8 power factor with a regulation of 11 per cent. and a line efficiency of 93 per cent., and a load of 20,000 KW. with a regulation of 14 per cent. and a line efficiency of 91.5 per cent.

The receiving station is situated at Parel on the Island of Bombay. It has been designed for an ultimate plant capacity of 74,880 K.V.A. in eight 3-phase step-down transformer banks of 9,360 K.V.A. each, and four incoming lines with the necessary switchgear and station auxiliary apparatus, of which five complete units and two incoming lines are now being installed.

The building is capable of extension as required, and the arrangement of the inlet tower, transformer compartments, and high-tension switchgear is the same as for the power house.

Each step-down transformer bank consists of three General Electric oil-immersed, water-cooled, single-phase transformers, delta-delta connected. These lower the pressure from 85,800 to 6,600 volts, 50 periods; the guarantees are practically the same as for the step-up transformers, the latter being of the same design, dimensions, and weights.

For the water-supply service to the transformers a system of cooling towers with water pumps, hot and cold well, and piping is installed. These are duplicate towers, each capable of cooling 18,000 gallons of water per hour from an inlet temperature of 107° F. to an outlet temperature of 87° F. with a wet-bulb temperature of 80° F. They are built of teak frames and posts, with bars and laths of jungle wood, and are treated with preservative compound.

There are three pump sets, each consisting of a self-regulating low-lift centrifugal pump, direct-coupled to an 8-H.P. 220-volt 50-period 1,450-R.P.M. 3-phase induction motor, and having a capacity of 20,000 gallons per hour against a total head of 45 ft. One pump circulates the water to the transformers from the cold well, which is situated beneath the tower, and another pump lifts the water from the hot well to the top of the tower, the third set being a spare.

The full-load requirements with five banks of transformers in circuit are 18,000 gallons per hour.

For improving the power factor and regulation of the system, duplicate synchronous-condenser sets are provided, each consisting of a 6,600-volt, 50-cycle, 500 R.P.M., 3-phase synchronous motor with a 125-volt exciter on the overhung part of the shaft.

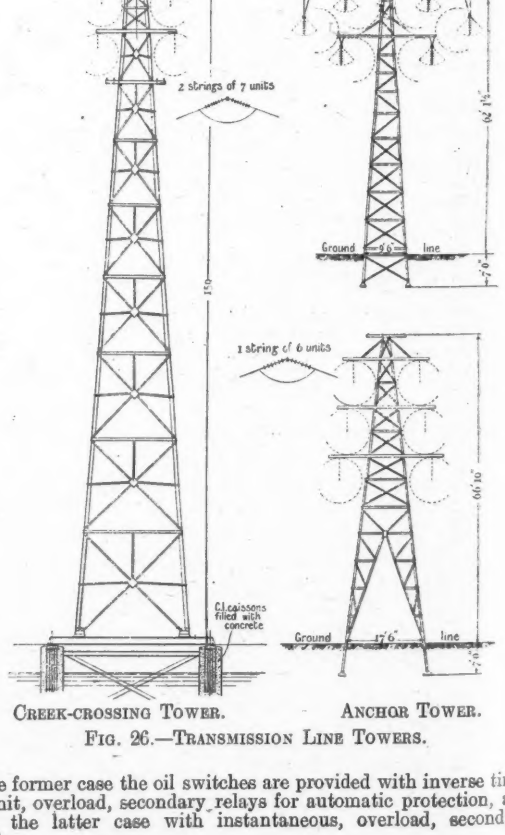
The motors are rated at 3,000 K.V.A. full-load input with a temperature rise of 60° F. for the armature, and 80° F. for the field, the atmospheric temperature being taken at 110° F., and the motors are capable of running at 20 per cent. overload for 10 hours without injury. The exciters are interpole, shunt-wound machines, rated at 25 KW. each.

The motors are started up direct from the 6,600-volt bus-bars through compensators, the starting current not exceeding full-load current; and the total running losses, including the power taken by the exciters, do not exceed 153 KW. at full load and 167 KW. at 20 per cent. overload.

The switchgear equipment consists of remote-control electrically-operated oil switches and other apparatus, which are operated from a benchboard, together with an auxiliary board for the station power and lighting circuits.

The equipment on the high-tension side is similar to the power-house equipment, except that the oil switches between the bus-bars and the transformer banks are automatically protected by the same relays as the low-tension oil switches.

The equipment on the low-tension side of the banks consists of triple-pole, motor-operated, automatic oil-switches in cell compartments, and current transformers and disconnecting switches, with similar equipments in the feeder circuits. In



CREEK-CROSSING TOWER. ANCHOR TOWER.

FIG. 26.—TRANSMISSION LINE TOWERS.

the former case the oil switches are provided with inverse time-limit, overload, secondary relays for automatic protection, and in the latter case with instantaneous, overload, secondary relays.

The low-tension 6,600-volt bus-bar system consists of copper bar, carried on insulators, in concrete compartments, sectionalised by means of disconnecting switches, whilst an auxiliary bus-bar is provided for the synchronous condensers and the station transformer. The plant is connected up on

the low-tension side by varnished cambric-insulated, fireproof-treated cable.

Each phase of the motor-operated oil switches is contained in separate oil vessels, which can be readily removed from the cells.

The station transformer bank is connected to the 6,600-volt bus-bar through a triple-pole, motor-operated oil switch with series, instantaneous, overload relays and disconnecting switches.

The control system is operated at 220 volts from a 60-ampere 8-hour battery, or from the 18 KW. charging set which also operates the series motors of the motor-operated oil switches.

Dividing boxes on the wall of the 6,600-volt bus-bar room connect the varnished cambric, single-conductor feeder cables to the armoured three-core cables which are run out of the building in an alley way to a cable chamber, where they are connected to the feeder distribution-system.

The feeder distribution-system from the receiving station to the mills is designed for a 6,600-volt 50-period 3-phase supply with an unearthed neutral. The cables are of the 3-core paper-insulated, lead-covered type, in standard sizes (viz., 0.1, 0.15, and 0.2 sq. in. section) and are laid on the solid system in bitumen in earthenware troughing in trenches 18 in. deep below the footway and 24 to 30 in. below the surface in side and main streets. They are designed for continuous operation at a current density of 1,050 amperes per square inch for the 0.2 sq. in. size, 1,240 amperes per square inch for the 0.15 sq. in. size, and 1,560 amperes per square inch for the 0.1 sq. in. size, with a reduction of 5 per cent. in the carrying capacity when two, and 15 per cent. when four cables are laid side by side. The mills are arranged in groups, each group having a feeder to each mill, with an emergency ring-feeder connecting up all the mills of the group.

The problem presented by the Bombay Mills was the conversion of mechanical to electrical drive utilising the present shafting, the change being effected with as little interference as possible with the production of the mills. The problem was thoroughly investigated, and after due consideration group driving with direct-coupled motors was adopted as being best suited to the requirements.

Standard speeds of 265, 290, and 365 R.P.M. were adopted.

The motors are of the slip-ring induction type, wound for 2,000 volts 3-phase 50-periods and provided with brush-lifting and short-circuiting gear, and are in standard sizes ranging from 30 to 500 H.P. They are designed for full-load rating with a temperature rise of 70° F. above air at 100° F., and for 50 per cent. overload for half-an-hour without undue heating. The full-load efficiencies range from 87 to 92.5 per cent., and the full-load power factors from 0.74 to 0.84.

The starting switches are of the liquid type, the electrodes being operated through slow-motion gear and the motors being designed to start up against the full-load torque with a starting current not exceeding the full-load current. In the case of callender machines special starters are required in order to meet the conditions of the service.

The mill transformers are of the 3-phase 6,600/2,200-volt 50-period oil-insulated, air-cooled, core type, are star-connected on both sides, and are provided with an earthing device. They are supplied in four sizes, viz., 500, 600, 700, and 900 K.V.A., from which the power requirements of each mill are met. They are designed for full-load rating at 0.8 power factor with a temperature rise of 70° F. above air at 100° F., and for 50 per cent. overload for half-an-hour without injury, and they have at full load a power factor of 0.8, an efficiency of 98 per cent., and a regulation at 0.8 power factor of 2.5 per cent.

The mill-lighting transformers are 6,600/240-120-volt 50-period single-phase, of the same type as the power transformers, and are in 10, 20, 30, 40, and 50-K.V.A. sizes, being designed for the same temperature rating. They have full-load efficiencies ranging from 96 to 97.65 per cent. and a regulation ranging from 1.95 to 1.2 per cent. at unity power factor.

A sub-station is provided at each mill for the transformers and switchgear, the feeders being connected up to the high-tension bus-bars through trifurcating boxes, single-conductor cables, a triple-pole oil emergency switch, and disconnecting links. The high-tension sides of the transformer circuits are connected to the bus-bars through similar disconnecting links, and the low-tension sides to the low-tension bus-bars through disconnecting links. The motor circuits are run from the low-tension bus-bars as 3-core paper-insulated, lead-covered and armoured cables to the switch pillars, and single-conductor cables of a similar type are run from the pillars to the motors.

The pillars are of the ironclad type with an interlocking design, and are fitted with a triple-pole, automatic oil-switch provided with an overload and no-voltage release, an ammeter, and an isolating plug box. The operating lever has to be in the "off" position before the switch can be opened for overhaul, thus preventing accidental contact.

The whole of the electrical equipment was subjected to insulation tests at the maker's works at a pressure three times in excess of the working pressure.

The present electrification contract covers 30 mills, requiring 63 transformers aggregating 39,500 K.V.A. and 199 motors aggregating 37,525 H.P., the power requirements of individual mills ranging from three motors aggregating 325 B.H.P. to 19 motors totalling 2,400 B.H.P.

All the mill engines were indicated for maximum and average indicated horse-power and tachograph tests were made of the loads on the shafts, the steam-driven rope drivers being replaced by direct-coupled motors which are installed in most instances in the rope races, on stagings built up of rolled-steel joists, the motor feet being fastened to the steelwork by means of foundation bolts.

In certain cases the motors are placed on steel-tower structures outside the buildings and are roofed in.

The terms of the agreement between the company and the mill-owners cover the supply of energy for power purposes in Bombay at 0.55 anna per unit in the case of mills where the company supply the complete equipment, and at 0.5 anna per unit in the case of mills which provide their own motor equipment, the company providing and maintaining the mill transformers. Energy for lighting is supplied at 1.25 annas per unit. The agreement is for a period of ten years.

The principal contractors for the work here described are as follows:—

Hydraulic works, Pauling & Co., Ltd.

Pipe line and headgear, Escher, Wyss & Co.

Power-house and receiving-station transformers and switchgear, General Electric Co., New York.

Turbines and generators, Siemens Bros. Dynamo Works, Ltd.

Transmission towers and insulators, Bullers, Ltd.

Mill equipments, British Westinghouse Electric and Manufacturing Co., Ltd.

Street distribution system, Callender's Cable & Construction Co., Ltd.

The following are the principal members of the engineering staff:—

Engineer in charge of hydraulic section, R. B. Joyner, C.I.E.

Resident engineer on hydraulic works, B. D. Richards.

Resident electrical engineer and general representative in India, H. P. Gibbs.

Chief of electrical staff, E. S. W. Moore.

Consulting engineer, Alfred Dickinson.

Discussion at Manchester.

Mr. J. S. Peck said the paper dealt with one of the largest undertakings in the world, and in view of the enormous expenditure involved in preparing dams and making the surrounding country sufficiently tight to hold the water, none but the most daring financiers and engineers would have made the attempt. The transmission voltage, *i.e.*, 100,000 volts, appeared very high for such a comparatively short length of line. Regarding the regulation of the generators, 22 per cent. at 0.8 power factor seemed rather low seeing that automatic regulators were used; 30 per cent. would appear more satisfactory. The cooling water was taken from the main pipe line, and it would seem more economical in view of the power value of such water to install a small pump to circulate the cooling water at lower pressure. The transformers were connected delta to delta, whereas the usual practice was delta to star; the latter arrangement gave a safer construction and permitted the neutral point to be earthed if desired.

Mr. S. L. Pearce referred to the very striking fact that the whole of the water was collected during the monsoon period; whilst the monsoon season occurred with appalling regularity, the amount of water could not be ensured, and it might appear possible for an exceptionally dry season to produce a shortage. Much value would have been attached to figures giving the cost of the hydraulic works and generator end. A Canadian engineer had remarked that whilst people thought power would cost next to nothing if derived through the agency of a hydro-electric company, the Britishers with large steam turbines were far ahead. The remark supported the view that large hydro-electric schemes could not compete with the large steam turbines in this country as regards turning out power cheaply. The transfer bus-bar, whilst usual at the present day, could be dispensed with by treating the step-up transformer and generator as one unit; the scheme would be cheaper, less complicated, and on the whole more reliable, and it was probable that the future development of large high-tension schemes would be along these lines. It seemed most striking that whilst energy was sold at 0.5 anna to the customers' own motor equipment, the additional price in the case of equipment supplied by the company was only 0.05 anna; calculations showed that the figure of 0.05 was little more than half what it should be if the cost of the mill equipment had to be written down in ten years.

Mr. Bristow stated that during the three months' monsoon season the rainfall in the district, which was 40 miles from the coast, was between 24 and 30 ft. The monsoon season up country failed much more frequently than near the coast, but it was possible even where this scheme was situated that a total failure might occur one year and be followed by a partial failure in the succeeding year. The monsoon varied sometimes to the extent of 50 or 60 per cent. in consecutive years, but when the scheme was laid out allowance was made for a complete failure succeeded by a partial failure. There was great diffidence with regard to the scheme at the commencement owing to the variable monsoon conditions, fissures in the rocks and lack of electrical knowledge amongst people who were expected to be chief customers. The chief thing which popularised the scheme was letting the mills have motors with the current. Roughly there were 30 mills supplied, and in practically every case it meant scrapping the entire steam plant. It was very doubtful whether any one of the mills would have done this and laid out fresh capital for new motor equipment. The price 0.55 anna was fixed for current and motor equipment, and when some enterprising

mill owner came along and asked what reduction would be allowed if he supplied his own motor equipment, the company fixed .05 anna. Motor equipment salesmen were soon on the spot to convince native proprietors that a saving could be effected by putting in their own motors and buying energy at .5 anna.

Dr. BOWMAN said that a case had occurred in Yorkshire where a dam which covered about an acre and was absolutely free from leakage showed a difference of level of 4 in. during one week-end due entirely to evaporation.

Mr. FENNELL said that in an installation of this kind the greater part of the charge for energy would represent standing charge, and it was of interest to know whether the promoters had considered the question of charging on the Hopkinson basis, having a fixed amount per H.P. to cover standing charges plus a small covering charge to cover running expenses. Periods of bad trade were sure to arise when the financial position of the scheme might be jeopardised.

Mr. MOORE, in reply to Mr. Peck, said that the 22 per cent. regulation at 0.8 power factor had been adopted as a middle course in the calculations, and so far there had been no reason to regret the decision. Concerning the present state of the scheme, one of the pipe lines was through and working one or two turbines; operation commenced during the past month, so that it was too soon to give operating experiences, although it might be said that in starting up the 100,000-volt plant nothing abnormal had occurred. Regarding the question of regulation, experience was somewhat limited and complexity was introduced by the number of banks of transformers in circuit. Ultimately it was decided to regulate up to the high-tension bus-bars automatically, using a Tirrill regulator for the purpose. A stand-by was considered desirable, and for that reason the Tirrill was placed on one side of the system and a Brown-Boveri regulator on the other side; the two were not operated together. The ventilation of the large fly-wheel generators presented a problem which was ultimately solved by putting in a large air duct from end to end of the building, with inlet and outlet towers well remote from each other. Automatic gates were used, controlled simultaneously with the generator field, so that when the field was excited the air was passing and *vice versa*. The question of cooling water from the pipe line was very carefully considered, having in view the economy of using a motor pump, but it was decided to start with a static supply from a ball valve tank. The oil was passed through coils, and water was also circulated from tanks through the bearings. The delta connection of the transformers was also decided after lengthy consideration. Regarding the question of rainfall raised by Mr. Pearce, the scheme was based upon charts and data carefully accumulated for many years. It was interesting to note that the large area of water had the effect of increasing the rainfall over the catchment area. The elimination of the transfer bus-bars was very attractive and simple if it could always be carried out, but in this particular case it was desirable to have means of transferring transformers rapidly. Standardisation of the methods adopted had shown 0.05 anna to be exceedingly reasonable for the costs of a mill installation. The effect of evaporation had been allowed for, and although figures were not accessible, the allowance was enormous. The governing of the turbines by deflecting nozzles had proved successful so far. The installation was not sufficiently advanced to permit the allocation of the charge for energy between capital and running expenses. The twisted sleeve joint had proved very satisfactory, both mechanically and electrically. Even if the resistance were twice that of an equivalent length of conductor, the effect would be immaterial. Regarding the suggestion of a fixed charge per H.P. to provide for a slack season, the Indian financiers had certainly protected themselves from any failure from that source.

COAL SUPPLY CONFERENCE.

ON Thursday afternoon, last week, a crowded meeting of representatives of the gas and electrical supply industries was held at the Institution of Electrical Engineers, in response to an invitation issued by Sir John Snell, to attend a national conference to discuss the shortage of coal supply and "for the purpose of considering the best course to adopt for bringing the far-reaching issues involved under the attention of the Government, with a view to some immediate measures of relief being obtained."

Sir CORBET WOODALL, who occupied the chair, drew attention to the extreme importance of adequate coal supplies to both the gas and electrical supply industries; he emphasised the obligations of suppliers of these commodities which justified their demands, and answered those who hinted that they were wanting in patriotism in bringing them forward.

In Germany the use of coal for gas making was being encouraged in view of the valuable by-products obtained.

The present position was brought about in the early days of the war by the commandeering of a large proportion of the shipping, which resulted in freight charges being increased for the remainder, and railway congestion added to the trouble. Now, owing to enlistment of colliers, the supply of coal was apparently less than the demand, and the highest possible prices were being asked for the output.

He thought it should be possible to prevent the exportation of coal so long as it was needed at home.

Sir JOHN SNELL (President, I.E.E.) expressed the willingness of the Council of the Institution to help matters forward, provided Government action was not hindered in any way; he took it that they wanted to improve the output of coal and transport facilities.

Ald. KAY (Manchester) said one could not control a large undertaking such as theirs without experiencing great alarm at the situation. The Manchester gas undertaking was in a worse position to-day than during the coal strike, and in his opinion there was no need for it. He moved a resolution in view of the vital necessity of gas and electricity for lighting, cooking, and for manufacturing purposes generally: (1) "That this meeting congratulates the Government on having appointed a committee to deal with the exportation of coal, and hopes that this may be effective in limiting exports, but views with the deepest concern the depleted stocks of coal and the difficulty, under present conditions, of renewing them for present and future requirements, and urges the Government to take further and immediate steps (*a*) to increase the output of coal from the pits, (*b*) to give greater facilities for the transport of coal by rail, and (*c*) to have regard, in requisitioning steam colliers, to the requirements of public utility undertakings which depend for their supplies on seaborne coal."

Unless there was some improvement, they could not hope to meet the normal winter demand, and he was afraid the Government did not recognise the position. Time was of the greatest moment, and even more important than money.

Mr. FRANK BAILEY (London), in seconding the resolution, said a Parliamentary Committee had inquired into the question of house coal supply and found the position serious, but he denied the necessity for every man to hoard up his little stock of coal when there were public utilities ready to supply his light, heat, and power requirements more efficiently. He urged that the requirements of gas and electric concerns should come first. He paid a tribute to the work being done by the gas undertakings, who used the greater quantity of coal but had a valuable by-product in coke. He considered that those who sold coal in London had not taken undue advantage of the situation; in some cases he thought they had lost money.

Mr. JOHN BOND (President, Inst. G.E.), in supporting the resolution, said his council had approached the Government on the question, and now the Board of Trade was taking action to prevent exportation.

Mr. R. A. CHATTOCK (representing the I.M.E.A.) said their position was that some hundreds of electricity undertakings were supplying works engaged on Government contracts. Last year they burnt some two million tons of coal, but the stocks were now reduced to 25 per cent. of their amount before the war. He was glad to see that the Government was helping some undertakings, but the price was some 50 per cent. higher than before the war. Lighting supply represented only a tithe of their output, and the power was almost all used in Government work. He urged that they must have adequate coal supplies at a reasonable price.

Mr. REGINALD NEVILLE, M.P., suggested that the desired result might be obtained by impressing on the consuming public the necessity of curtailing the use of gas and electricity.

Prof. Sir ALEX. KENNEDY expressed sympathy with the resolution, agreeing that the London coal men were not making extra profit at the present time; other speakers suggested that this was really a consumers' question, and would be settled if the Government found the voters in opposition; that the definite idea in the resolution was the restriction of export of coal, and a strong point should be made of the dependence of the work of the country on electricity and gas; that the root of the question was the output of the coal workers, which could be increased if the Government, which had power to do it, suspended Clause 4 of the Coal Mine Regulations Act, 1908, which prescribed the working hours; also that in some districts the output of coal had actually increased as compared with last year.

In the end the resolution was adopted practically unanimously.

Ald. PHILLIPS (Salford), while agreeing with the first resolution, thought it did not go far enough, as it left out the important question of price. He therefore moved:—

(2) "That the Government be asked to take such steps as may be necessary to reduce the price of coals to reasonable limits."

The Board of Trade Committee had admitted that prices had risen out of all proportion to the situation, and had hinted at the possible necessity of the Government taking over the supply of coal.

This resolution was seconded by Ald. HALL (Workington), who considered that there was strong reason to ask for Government inquiry into the methods of selling coal in view of the part taken by coal associations in fixing prices.

Mr. JOHN CHRISTIE (Brighton) urged that the Chancellor of the Exchequer should surcharge ship-owners so as to limit their profits to 15 per cent.; in their case coal freights by sea were costing £15,000 a year for services worth about £5,000.

The resolution was also discussed by other speakers, one of whom pointed out that the resolution left the price quite in doubt, and to remedy that proposed an amendment, which

was lost, the original resolution being carried by a large majority.

The CHAIRMAN then moved the third resolution, which was seconded by Sir JOHN SNELL, and was as follows:—

(3) "That a representative deputation of the gas and electricity industries be now appointed to present our case to the members of Parliament and to take such further action as may be found advisable.

That a conference with members of Parliament be held in London to seek their aid in urging upon the Government immediate action to give effect to the above recommendations.

That each authority represented pledges itself to take steps to secure the presence of their member or members of Parliament at the proposed conference."

The composition of the deputation, which was approved by the meeting, is as follows:—Sir Ryland Adkins, M.P., director, Herne Bay Gas & Electricity Co.; Mr. Edward Allen, engineer, Liverpool Gas Co.; Mr. F. Bailey, joint managing director, City of London E.L. Co.; Mr. J. Ferguson Bell, manager, Derby Gas L. & Coke Co.; Sir Joseph Bellamy, chairman, Plymouth and Stonehouse Gas L. & Coke Co.; Mr. John Bond, president, Inst. Gas Engineers; Mr. W. G. Bradshaw, chairman, Commercial Gas Co., Lond.; Dr. Charles Carpenter, chairman, South Met. Gas Co.; Mr. W. A. Chamen, engineer, South Wales E.P.D. Co.; Mr. R. A. Chattock, acting president, I.M.E.A.; Mr. F. E. Cooper, sec., Gas. Co.'s Protection Assoc.; Mr. A. C. Cramb, president-elect, I.M.E.A.; Mr. W. T. Dunn, sec., Inst. Gas Engineers; Mr. Hardman A. Earle, Yorks. Elec. Power Co.; Sir J. Fortescue Flannery, Bart., M.P., director, South Suburban Gas Co.; Sir D. Ford Goddard, M.P., chairman, Ipswich Gas L. Co.; Mr. J. S. Highfield, engineer, Met. Elec. Supply Co.; Captain R. S. Hilton, manager, Birmingham Corp. Gas Dept.; Bailie Irwin, chairman, Glasgow Corp. Gas Comm.; Mr. J. R. H. Jacobs, sec., Southampton Gas L. & Coke Co.; Mr. H. E. Jones, chairman, Wandsworth, Wimbledon and Epsom Dist. Gas Co.; Ald. Kay, chairman, Manchester Corp. Gas Comm.; Sir Alexander Kennedy, F.R.S., cons. engineer, Westminster Elec. Supply Corp., Ltd.; Mr. A. Masterton, engineer, Edinburgh and Leith Corp. Gas Dept.; Mr. C. H. Merz, Newcastle-upon-Tyne El. Supply Co.; Mr. Reginald Neville, M.P., chairman, Brentford Gas Co.; Mr. G. W. Partridge, chief engineer, London Elec. Supply Corp., Ltd.; Mr. S. L. Pearce, chief electrical engineer, Manchester; Ald. F. S. Phillips, chairman, Salford Corp. Gas Dept.; Mr. W. E. Price, engineer, Hampton Court Gas Co.; Mr. P. F. Rowell, sec., Inst. Elec. Engineers; Mr. A. H. Seabrook, manager, St. Marylebone Elec. Supply; Mr. James Smith, engineer, Belfast Corp. Gas Dept.; Bailie W. B. Smith, chairman, Glasgow Corp. Elec. Dept.; Sir John Snell, president, Inst. Elec. Engineers; Mr. C. P. Sparks, chief engineer, County of Lond. Elec. Supply Co.; Sir Albert Stanley, managing director, London Elec. Railway Co.; Mr. C. D. Taite, engineer, Lancs. Elec. Power Co.; Mr. Hanbury Thomas, managing director, Sheffield Untd. Gas L. Co.; Mr. F. J. Walker, Conf. Chief Officials of London Elec. Supply Cos.; Mr. D. Milne Watson, general manager, Gas L. & Coke Co.; and Sir Corbet Woodall, governor, Gas L. & Coke Co.

The CHAIRMAN said the names were numerous, but it was quite right that this should be so; the proceedings closed with votes of thanks to the Institution of Electrical Engineers and to the Chairman.

SOME PECULIAR VIEWS ON ELECTRIC LIGHT SWITCHING.

By W. PERREN MAYCOCK, M.I.E.E.

It may be mentioned to start with that by "Electric Light Switching" is here meant the control of glow-lamp circuits by means of small local switches—mostly of the tumbler variety.

It is, perhaps, hardly necessary at this time of day to point out that quite a number of other electrical types of tumbler switch besides the single-way are available, and that their intelligent utilisation forms almost as important a branch of electric-light fitting as attention to the requirements of satisfactory illumination.

Without entering into details, it may be stated that there is as much difference between an installation fitted with due regard to modern switching conveniences, and one fitted in the ordinary manner, as there would be between the latter and an installation with all the switches in the lampholders.

It may interest some readers of this journal to know that your contemporary *Electricity* is publishing this month one of the periodical sets of examination papers in electric-light switching due to Messrs. A. P. Lundberg & Sons; and those who are not acquainted with these examinations might do worse than investigate this subject. That it calls for investigation by many who are concerned with electric light fitting is very obvious to those who know what peculiar ideas of it some people have.

It is proposed to confine this article to a few instances which were quoted in reply to the following question in the last examination:—

"Cite any instances that have come to your notice of the deplorable ignorance of the connections and conveniences of modern controls that exists in some quarters. As an example, there was a consulting engineer who objected to the use of 'Twinob' switches because of the danger of short-circuiting."

The writer (who was the examiner) has taken care to put the various cases without any exaggeration, though a little disguise has been necessary. The few examples that are given are obviously but a drop in the ocean to those that must occur daily.

(*a*) A two-way-intermediate circuit had been fitted up in a tunnel, where it proved of undoubted advantage. The chief afterwards remarked to the fitter—referring to the intermediate switch—"I suppose that's one of those 'Twinobs' down there." The point here is the confusion of the Intermediate with the "Twinob" switch, whose functions are quite different.

(*b*) An intermediate switch was suggested as a necessary addition to a two-way control in a railway station, at a point quite close to the existing strapping wires. The foreman was averse to the idea, as he thought it involved bringing the "feed" up to the switch. As a matter of fact, all that was necessary was to cut the strapping-wires, lengthen them slightly, and connect them into the intermediate switch.

(*c*) A two-way control was ordered for the yard of a works, and an intermediate switch was suggested for a mid-way point past which the two-way strapping wires had to run. The proposal was not appreciated because it meant "two or three extra wires to the switch." In reality no more wire was required.

(*d*) The second engineer to a very large provincial electric supply department considered two-way control a great novelty, and asked some of his wiremen if they had ever heard of it, and whether they could do it. Actually, the two-way control is something like a quarter of a century old!

(*e*) An electrician-in-charge started on the wiring of a new circuit, which included a two-way control. When the time came to wire-up to the switches, our friend was taken suddenly ill, and his illness was so protracted that a contractor was deputed to finish the work. As soon as this arrangement was entered into, the electrician recovered and resumed his duties in company with the contractor's wireman!

The conclusion that may be drawn is clear.

(*f*) For a certain very important purpose a two-way intermediate control was required on a ship. This requirement proved to be beyond the powers of several "specialists." After some months' waste of time on this intricate problem the writer (examinee) ventured to fit up the control himself, to the surprise and confusion of the "specialists," who had seen nothing like it. The switches have since been on continuous and satisfactory duty night and day for many months.

(*g*) There was a professional man who, although also an amateur electrician, proposed to revert to gas because his electricity bill was higher. Happily, a friend stepped in, introduced a few modern controls which effected economy in consumption, and so saved the situation.

(*h*) A series-parallel-and-off switch fitted on a steamer proved a puzzle to an electrical engineer, who had to be shown by a friend that there was a central or "off" position.

(*i*) A firm of London contractors of some repute once tried to obtain two-way-intermediate control with three two-way switches!

(*j*) An institute is being built in Scotland, and is to be lighted by electricity. The lighting committee consists of some half-dozen people whose knowledge of the subject is of the vaguest kind. Advice on modern controls was tendered by the one qualified electrician in the district, but was rejected, and the single-way switch is to hold undisputed sway.

It will be observed that most of the above examples relate to two-way or two-way-intermediate circuits. It may, therefore, be assumed that the somewhat more special controls—restrictive, master, or pilot—for instance, still remain to be discovered by many people of technical repute.

Locating Projectiles by A.C. Electromagnet.—According to a note to the Académie des Sciences by M. J. Bergonié, alternating-current electromagnets have been used successfully in Temporary Hospital No. 4 (Grand-Lebrun) at Bordeaux, to locate shell splinters, German bullets or other magnetic projectiles in wounded soldiers. Best results have been obtained when using a core of insulated plates 0·2 mm. thick, 75 cm. long and 7·7 cm. in diameter, wound with 252 turns of wire carrying 23·5 amps. at 240 volts, 50 cycles per second. The alternating magnetic field thus produced sets in vibration any magnetic material embedded in living tissue, and either by visible vibration of the surface of the flesh or by a trembling drag on the hand holding the magnet, it permits the detection and approximate localisation of magnetic splinters and bullets. Holding the core just clear of the flesh, it is said to be possible to locate a 5 gm. splinter or bullet at a depth of 10 cm. and, without the aid of radiography, to ascertain quickly where the metal is nearest the surface, and hence the means by which it can best be removed. In the original communication (April 6th, 1915), several examples are given of the application of this new method.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,178. "Protecting electrical conductors." A. MARR & J. LISTER. April 26th.

6,196. "Combination electric switch and fuse." A. H. SHORT. April 26th. (Addition to 8,456/14.) (Complete.)

6,197. "Controlling mechanism for automobiles." BRITISH THOMSON-HOUSTON CO., LTD. April 26th. (General Electric Co., United States.)

6,217. "Wireless telegraphy." C. M. AGNER. April 26th. (Convention date. June 8th, 1914, United States.) (Complete.)

6,222. "Combined electric switches and plug couplings." G. MARKT. (Complete.) April 26th.

6,244. "Telephone transmitters." M. S. CONNER & A. R. KAHL. April 27th.

6,253. "Method of obtaining a sparkless break of an inductive electrical circuit." T. F. WALL. April 27th.

6,259. "Electro-magnetic projectile-transmitting apparatus." E. BACHELET. April 27th.

6,273. "Means for applying electric treatment." G. VERNON-WARD. April 27th.

6,296. "Arc lamps adapted to be used also for the production of electrical oscillations for wireless telegraphy, wireless telephony, and for other purposes." L. MAUCLAIRE & A. BREON. April 27th.

6,297. "Fluid-pressure controlling-systems." H. T. KERR. April 27th. (Convention date, May 19th, 1914, United States.) (Complete.)

6,302. "Electrically-actuated tools." W. J. MELLERSH-JACKSON. April 27th. (Commonwealth Electric Tool Co., United States.) (Divided application on 21,143/14, October 17th.) (Complete.)

6,314. "Renewable terminal for electric ignition and the like accumulators and other purposes." B. BARBER. April 28th.

6,343. "Portable dry batteries, as adaptable and employed for ringing electrical bells and the like." J. W. LEA. April 28th.

6,349. "Ball-and-socket joints." BRITISH THOMSON-HOUSTON CO., LTD. April 28th. (General Electric Co., United States.)

6,362. "Automatic signalling arrangement for tramway lines or electric railways." D. SAMAIA. (Addition to 10,434/12.) April 28th. (Complete.)

6,364. "Electrically-actuated tools." W. J. MELLERSH-JACKSON. April 28th. (Commonwealth Electric Tool Co., United States.) (Divided application on 21,143/14, October 17th.) (Complete.)

6,373. "Incandescent electric lighting." J. S. HECHT. April 29th.

6,374. "Electric conductors or cables." W. E. HITCH. April 29th.

6,407. "Regulation of dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD. April 29th. (General Electric Co., United States.)

6,408. "Electric motors." BRITISH THOMSON-HOUSTON CO., LTD. April 29th. (General Electric Co., United States.)

6,412. "Electric-arc soldering." E. H. JONES. April 29th.

6,457. "Electrical fire-alarm systems." SIEMENS & HALSKE AKT. GES. April 30th. (Convention date, May 1st, 1914, Germany.) (Complete.)

6,466. "Combined electric-light fitting and clock." B. RIES. April 30th.

6,469. "Controlling mechanism for dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD. April 30th. (General Electric Co., United States.)

6,476. "Cathodes of vacuous tubes suitable for use in wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO., LTD., & H. J. ROUND. April 30th. (Divided application on 13,247/14, May 29th.)

6,480. "Telephone systems." H. S. TURNER. April 30th. (Convention date, June 20th, 1914, United States.) (Complete.)

6,486. "Wireless telegraph and telephone systems." L. DE FOREST. April 30th.

6,495. "Rotary field magnets." SVENSKA TURBINFABRIKS AKTIEBOLAGET LJUNGSTROM. April 30th. (Convention date, June 22nd, 1914, Sweden.) (Complete.)

6,542. "Electric signalling system for railways." W. J. MACKENZIE. May 1st.

6,551. "Arrangements for transmitting and receiving signals by electro-magnetic waves." O. IMRAY. May 1st. (Samuel M. Kintner & Halsey M. Barrett, United States.) (Complete.)

6,558. "Leakage protection device for electric cables." W. J. HOWARD. May 1st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

17,889. ELECTRIC LAMP CASINGS. H. H. Hirsch. August 5th.

27,533. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. and F. Newforth. November 29th.

1914.

1,969. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. and F. Newforth. January 24th.

3,702. INCANDESCENT LAMP SOCKETS. H. Marks & S. Helsel. February 12th.

4,908. ELECTRICAL HAIR BRUSHES, MASSAGE BRUSHES, AND THE LIKE. Tokalon, Ltd., & M. F. Pratt. February 25th.

6,209. ELECTRICAL IMPULSE TRANSMITTERS AND THE LIKE. Betulander Automatic Telephone Co. & W. Aitken. March 11th.

6,214. MEANS FOR THE ELECTRICAL TRANSMISSION AND DISTANT CONTROL OF MOVEMENTS SPECIALLY APPLICABLE TO SYSTEMS FOR SIGNALLING ORDERS AND THE LIKE. E. H. Graham & W. J. Rickets. March 11th.

8,931. MAGNETOS AND OTHER ELECTRIC GENERATORS. A. Keller-Dorian. April 8th. (April 14th, 1913.)

9,035. ELECTRIC SWITCHES. J. H. Tucker & J. A. Crabtree. April 9th. (Cognate application, 18,942/14.)

9,056. METHODS OF AND APPARATUS FOR SHAPING FILAMENTS. British Thomson-Houston Co. April 9th. (General Electric Co.)

9,305. ELECTRIC COUPLINGS OF THE PLUG AND SOCKET TYPE. J. W. Annand. April 15th.

9,578. DYNAMO-ELECTRIC MACHINES OF THE ALTERNATING-CURRENT COMMUTATOR TYPE. British Thomson-Houston Co. & N. Shuttleworth. April 17th.

9,648. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co., A. B. Sperry, & A. J. Ray. April 18th.

9,659. ELECTRIC LIGHT SHADE CARRIER OR HOLDER. R. J. Eskrigge. April 18th.

9,726. CONTROL OF ELECTRIC FAN MOTORS. S. G. Jones, F. E. Wilson, and W. A. Shepherd. April 20th.

12,233. TELEPHONE CALL RECORDERS. D. J. McGauran. May 18th. (July 22nd, 1913.)

15,031. SPARK GAPS FOR RADIO-TELEGRAPHY. E. Girardeau & J. Bethenod. June 23rd. (February 25th, 1914. Addition to 14,884/14.)

15,155. CONTROLLING ARRANGEMENTS FOR DIRECT-CURRENT ELECTRIC MOTORS. Soc. Anon. Dite. S.T.A.R. (Systeme de Traction Auto-Regulateur.) June 24th. (July 21st, 1913.)

17,986. ELECTRIC TIME SWITCHES. J. E. H. Beraud. July 29th. (Addition to 945/14.)

18,277. MEANS FOR CONNECTING ELECTRIC CONDUITS TO THEIR FITTINGS. A. Myers & L. Myers. August 7th.

20,131. RHEOSTATS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). September 24th.

21,090. ELECTRO-MAGNETIC PERFORATORS. E. Thompson. October 16th.

21,906. REVERSIBLE PIN AND SOCKET COUPLING FOR ELECTRICAL APPARATUS. W. A. S. Benson & Co. and E. Ellwood. November 3rd.

21,952. ORDER TELEGRAPHS. E. A. Graham. November 3rd.

1915.

1,377. ELECTRIC COOKING OVENS. J. T. Negus & Negus. January 28th. (Divided application on 9,213/14, April 14th.)

Nickel-Plating Aluminium.—The difficulty of electro-plating aluminium with nickel lies not in devising a suitable electrochemical process but in securing a coherent deposit. An intermediate coating has generally been considered indispensable between aluminium and nickel, and copper, zinc and iron have been proposed and tried in various ways. In the first place, however, a chemically clean surface must be secured on the aluminium, and to the well-known difficulty of obtaining this must be attributed failure to secure a deposit which will stand mechanical working. A new process described by MM. Canac and Tassilly before the Société d'Encouragement pour l'Industrie Nationale, is claimed to overcome this defect. The aluminium piece to be plated is passed first through a boiling potash bath, then brushed with milk of lime, dipped in a 0·2 per cent. potassium cyanide bath for several minutes, and finally subjected to attack by an iron chloride solution (500 gm. hydrochloric acid, 500 gm. water, 2 gm. iron), till the appearance of the aluminium resembles crystallised tinplate. After each stage in this treatment the work is thoroughly washed in water. The following is found to be a satisfactory nickelling solution:—Water, 1,000 cc.; nickel chloride, 50 gm.; boric acid, 20 gm., worked at 2·5 volts and 1 ampere per sq. dcm. The deposit obtained is matt-grey on leaving the bath, but easily takes a good polish under the scratch brush. Above all, it is claimed that the coating will stand bending and hammering without peeling or cracking. The reason for the adherence of the deposit appears to lie in the strong reducing action of the nascent hydrogen evolved when the aluminium is plunged in the ferric chloride pickle. Metallic iron is deposited on the aluminium, and, though its amount is so small (0·25 to 0·5 gm. per sq. metre), that it cannot form a continous intermediate deposit, the iron forms with the aluminium a number of tiny couples favouring attack by the acid pickle. The surface of the aluminium is thus very minutely but very completely pitted so that, besides being deposited on the nearest practicable approach to a chemically pure surface, the nickel coating is actually locked or "rooted" into every part of the aluminium surface, and it is on this mechanical action that the tenacity of the deposit depends. Aluminium thus protected is said to be unaffected by moist air, dilute and boiling soda, acetic acid, sea salt, wines, and foodstuffs, and does not permit leakage of petrol. It is recommended as useful for electrical conductors and is claimed to extend greatly the possible applications of aluminium.

Wireless Control of Public Clocks.—A letter from Mr. A. E. Ball, in the April number of the *Horological Journal*, replies to the remarks of Mr. Hope Jones on this subject, mentioned in our issue of April 30th. Mr. Ball points out that to check each clock locally by the Eiffel Tower signals destroys the essence of his scheme—central control—and involves checking the local observers. The cost of the wireless control, he says, is small, and the latter, with a wave length of 50 m., in no way interferes, even with amateurs who use 200 m. Moreover, at the times chosen for checking the clocks, 10 a.m. and 3 p.m., hardly any amateurs would be at work.

Reporting back by wire involves a cost for wayleaves, &c., out of all proportion to the advantages gained.

Oil-Electric Barges.—A novel type of barge propelled by electric motors, the power being obtained from dynamos driven by oil engines, is to be put in service by the Mississippi Electric Navigation Co., of St. Louis.

The arrangements adopted are extraordinary. There are two 240-H.P. Diesel engines, driving dynamos in the engine room, where are also located the auxiliary lighting and pumping sets. For the propulsion there are four screws, each driven by an electric motor, which is external to the boat and enclosed in a watertight casing. All the motor-propeller units are hinged together, and serve as a rudder. The boats are designed to carry 1,000 tons on a draught of 5 ft. 6 in., and are to be fitted with three loading cranes. The total cost of construction is said to be about £14,000.—*Motor Ship and Motor Boat.*